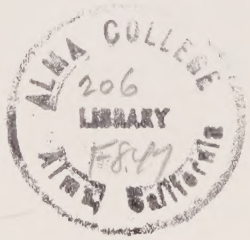
NATURE
THE MIRROR OF GOD

VOLUME XXXVI
1955

Franciscan Educational Conference
CAPUCHIN COLLEGE
WASHINGTON, D. C.

NATURE
THE MIRROR OF GOD

Report of the Thirty-Sixth
Annual Meeting
of the
Franciscan Educational Conference
St. Anthony-on-the-Hudson, Rensselaer, N. Y.
Aug. 16–19, 1955



Published by
The Franciscan Educational Conference
CAPUCHIN COLLEGE
WASHINGTON 17, D. C.

VOL. XXXVI Dec. 1955

CUM PERMISSU SUPERIORUM

Printed in the United States of America

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DEDICATION

This volume

is

respectfully dedicated to the

Very Rev. Urban Freund, O.F.M.

the first Secretary

and one of the founders of the F.E.C.

and to

Rev. Philotheus Boehner, O.F.M.

in grateful memory

of their service to Franciscan education.

REQUIESCANT IN PACE!

THE CHALLENGE OF SCIENCE TODAY

Ignatius Brady, O.F.M.

Sentire cum Ecclesia, to be of one mind with the Church, has always been the mark of a true Christian and a true Franciscan. In this, we have before us the living example of our holy Father Saint Francis. *Franciscus, vir Catholicus et totus Apostolicus,* he is saluted in the Franciscan Breviary: Francis, a man who was completely Catholic and wholly devoted to the Apostolic See.

When, therefore, Saint Francis became conscious of the desires of the Holy See, when he learned from the lips of the Holy Father or the decrees and decisions of the Councils what were the needs of the Church and the world, he hesitated not to put himself and his Order entirely at the service of the Church. To be specific: there are good historical grounds for saying that the tremendous emphasis Saint Francis places on the Holy Eucharist in all his writings is the fruit not only of his own faith and devotion but also and directly of the suggestions, directions and commands of Pope Innocent III and the Fourth Council of the Lateran (1215). Or again, the whole scholarly development of the Order at Paris and elsewhere is a result of the directives of Honorius III and Gregory IX.

In keeping with such whole-hearted devotion and attention to the Holy See and obedience to its directives and commands, the whole Franciscan Family must ever be ready to go where sent, to do what is asked, to bring its whole tradition and teachings to bear on the problems presented to the Church by the voice of Saint Peter.

The Pope and Science

This is what we hope the 1955 meetings of the Franciscan Educational Conference, both the August meeting for the friars and the November meeting of the Teaching Sisters, will in a modest way at least prove to be. Our theme is "Nature: the Mirror of God"; our goal, to capture in some degree the Franciscan approach to creation

and through creation to God; our purpose, not to speculate alone but through such considerations, studies and discussions, to help answer the problems of modern science and philosophy which in recent years have been the subject of many Papal allocutions and letters.

If the Holy Father is concerned over such questions, if he has lamented the divorce of science and philosophy, indeed of science and the rest of human life; if he has welcomed the advances of science yet warns of the role philosophy must fill in attaining a synthesis of knowledge so badly needed today, then it must be our concern and our task to contribute to the solution of such problems.

We have only to read the address of the Holy Father to the delegates of the Tenth General Assembly of the International Union of Geodesy and Geophysics, September 25, 1954, to appreciate his interest in the advances of science and the needs of the scientist.[1] Of even greater moment, however, is the marvelous allocution to the Pontifical Academy of Sciences this past Spring.[2] Variously titled "Science and Philosophy," and "The Challenge of Science," it not only pays tribute to the vocation and dignity of the scientist, but studies at length and with great insight "the problems of an intellectual nature" which modern science faces. In particular, the Holy Father makes great point of stressing the necessity of metaphysics. Science needs philosophy both to understand what it itself is doing and whither it is going.

Thus, the Pontiff pictures science as pondering the greatest enigma of all visible creation, the problem of life. Not science, however, but philosophy must provide the answer to that problem, by stating "precisely the distinctive traits of vital factors, the necessary character of the underlying principle of unification, the internal source of action, of growth, of multiplication, the true unity of the living being. It shows too what matter, in some of its fundamental aspects, must be that there may be realized in the living being the characteristic properties which constitute it." [3] Science then cannot

[1] "En accueillant," in *The Pope Speaks,* I, n. 3 (1954), pp. 25–3257.

[2] "Au moment" (April 24, 1955), in *The Pope Speaks,* II, n. 2 (1955), pp. 113–120; see also a slightly truncated text in *The Tablet* (London), v. 205, n. 6003 (June 11, 1955), pp. 570–571.

[3] "Au moment," *TPS, loc. cit.,* p. 116.

of itself alone fully penetrate the intimate structure of material beings. It must look to philosophy for the full interpretation.

Again, the Pope continues, science of itself cannot reach a coherent and unified view of the truth. Merely to put facts together as in a kind of mosaic produces an anatomical composition of knowledge from which life seems to have departed. The force required to produce the organic and universal synthesis of doctrine needed today cannot come from science; it is the work of philosophy.

This calls for an alliance of science and philosophy which unfortunately is too rare today. The current separation does not, however, justify the pessimism and scepticism of those who have abandoned all hope of producing any grand universal synthesis. "We rather think that the natural sciences, in permanent contact with a philosophy of critical realism . . . can arrive at an all-embracing view of the visible world which would, to some extent, satisfy the quest and ardent desire for truth." [4]

Franciscan Approach

Such is the challenge the Pope offers the scientists and philosophers of today. If then we would be true to the age-old Franciscan tradition and training of loyal devotion and obedience to the Holy See, we Franciscan educators cannot be slack in accepting such a challenge, but each in his own way, within the field of education assigned to us, and to the limits of our powers, must seek to answer it. To some it is given to be scientists, to others to be philosophers, while the rest of us occupy the less noble perhaps yet certainly important task of teaching science or philosophy. To each his task and his duty.

The scientist, the Holy Father says, is a man faced with a destiny and responsible more than others for the good or evil he may do.[5] To him it is given to study and peruse the book of nature, in which each thing is as it were one of God's words and bears the mark of what we might call the fundamental alphabet—those natural and universal laws that are derived from yet higher laws and harmonies. He must handle that book with care and reverence, turning it page

[4] *Ibid.*, p. 119.
[5] "En accueillant," TPS, *loc. cit.*, p. 256.

by page and reading it in an orderly manner, to come to a deeper understanding. To him it is given to be in a sense the discoverer of the intentions of God, to interpret this book, describe its contents, and draw the consequences therefrom for the good of all.[6]

Can the Franciscan scientist have any greater inspiration in this duty and privilege than that bestowed by the spirit of Saint Francis, who read the book of nature with so much fruit, who discovered God's mark in all things, and who, to change the metaphor, made of all things a ladder to God? But to develop this further would intrude on the excellent paper of Father Leander.

Again, the work of the scientist must itself be the service of God and of fellowmen. He must recognize God the creator, for He is the Truth outside of which nothing has any real meaning. He must use his knowledge in the service of God, for a science cut off from the rest of life becomes useless and even harmful.[7] Let us hope that the Franciscan spirit of learning, with its concreteness and practical goals, its totality or wholeness of view, will keep a friar scientist from becoming a cold and detached observer.

In the same vein, may the architectonic feeling for wholeness which is found in a Saint Bonaventure, for whom all sciences were organically and hierarchically related, lead our scientists to seek the help of philosophy to elaborate some part at least of a synthesis of knowledge so needed today. Let them set an example not only of scientists true to the methods, principles, goals and limitations of science, but also of men possessed of the higher and more unifying knowledges of philosophy and theology.

Errors of the Past

On the other hand, the Franciscan philosopher will not be guilty of the errors of the past, when unfortunately too many of his predecessors failed to follow the progress of science and in consequence clung to positions and doctrines that they had more profitably abandoned. He should, rather, be imbued with that progressive spirit that ought to be a mark of the Franciscan School.[8] Certainly

[6] "Au moment," *loc. cit.*, p. 113.

[7] "En accueillant," *loc. cit.*, p. 256.

[8] Cf. P. Boehner, O.F.M., "The Spirit of Franciscan Philosophy," *Franciscan Studies,* II (1942), 217–237; especially pp. 229–233.

the great leaders of Franciscan Scholasticism were possessed of an originality, vitality and freedom that must be our inspiration. On the one hand, we cannot fossilize our thought in such rigid patterns that progress is impossible, nor on the other should we be hasty in abandoning older traditions without a rigorous evaluation of both *nova et vetera*. With the Church we should be soundly progressive and healthily modern.

Certainly too the Franciscan philosophy has much to offer on the problems faced today by both science and philosophy alike, the questions of life, matter, plurality of forms, movement. It is to be hoped that Franciscan philosophers who are also scientists will have the time, leisure and opportunity to make a definite contribution.

Teacher of Science

Lastly, the Franciscan who is in the lower dignity, if I may so speak, of a teacher of science and/or of philosophy, has a similar trust which he cannot betray. To the science-teacher as well as to the scientist himself are addressed the words of the Holy Father: "Be you also the teachers who explain to your fellowmen the wonders that are unfolded in the universe . . . teachers eager to reveal the beauty, power and perfection of creation, that they may be enjoyed by others. Teach others to behold, to understand and to love the created world, so that the admiration of splendors so sublime may cause the knee to bend and invite the minds of men to adoration. Never betray these aspirations, this trust. . . . The hearts and gaze of those who listen to you are, as it were, hanging on your every word, ready to chant a hymn of praise and thanksgiving." [9]

But to do this, the teacher of science must teach science as good science. Even though the ultimate goal is supernatural, he cannot neglect to the least the natural, which is after all the foundation of the supernatural. The practical implementation of this is most admirably brought out by the paper written for us by the late Father Philotheus, whose presence we miss so sadly.

For his part, finally, the Franciscan teacher of philosophy should evince a deeper appreciation of the claims and accomplishments of

[9] "Au moment," *loc. cit.*, p. 120.

science, and above all help his students to see how both philosophy and science are separate but not separated spheres of knowledge. The approach he should have to the study of creation will, I am sure, be illustrated by several of the papers on our program. In particular, the use one may make of the findings of science will be aptly brought to our attention by Father Kieran.

PROBLEMS OF THE ATOMIC AGE

Honorable Thomas E. Murray
Commissioner, U. S. Atomic Energy Commission

If St. Francis were to live in this atomic age he would probably refer to atomic energy as "Brother Energy." He would undoubtedly look upon all atomic energy as a friend, even as he reverently gazed upon the thirteenth century world with spiritual eyes that saw only the glorious work of God's hand. If he spoke of "Brother Sun," "Mother Earth," "Brother Fire," and "Sister Water," then surely he would have called the combined energy of the universe "Brother."

You as sons of St. Francis have inherited this creative spirit of love for God's universe. This personalized attitude toward and interest in the world today is what the twentieth century needs. It must realize that the world and its elements are friendly and should be treated and used as such. Your Educational Conference is truly Franciscan in referring to nature and the study of nature as the "Mirror of God." God's hand must be seen guiding the hand of man, lest man's hand attempt to guide the hand of God. To envision the power of God in the power of the universe will teach us respect and reverence and love for the earth and its inhabitants. To see God in all things, as St. Francis did, is one way of solving many of the problems of the atomic age.

Aspects of Problems

In keeping with the purposes of this Conference I shall attempt to indicate some aspects of the problems of our atomic age by discussing the effect of atomic developments on some of man's fundamental relationships. By these I refer to the relationship of man to his Creator, to his environment in nature, and to his fellowman.

It is now just a decade since a blinding flash over the sands of Alamogordo heralded the dawn of the atomic era. Whether we knew it or not, life changed for us with the detonation of that first atomic bomb. It would be a mistake, however, to regard that event as a

completely new revelation in the natural order. We must understand it rather as the culmination of ages of study and research dedicated by man to increased understanding of the universe. The search for this understanding is a part of man's duty, the effect of a primal urge implanted in his nature by his creator, to discover more and more of the world in which he lives and the universe by which he is surrounded. It is a part of the instinctive search for God to be found in each and every one of us. For in the unity, harmony, and order of the universe, as it unfolds little by little and at great cost to man's inquiring mind, there are to be found finite reflections of the Unity, and Order, and Harmony, which are the perfections of God Himself. That is, as the theme of this Conference so appropriately states, Nature is the Mirror of God.

What happened at Alamogordo is but the natural and logical outcome of a process that has been continuing throughout the long centuries of man's history. The general concept of the atomic structure of matter can be found among the scholars of Ancient Greece 2500 years ago and even among the Hindus of an earlier era. Every age has contributed something to the theory—legions of scientists and philosophers have added to its development.

All these efforts have at length come to fruition in our own day. The result has been a far-reaching alteration in man's relationship to nature, so far-reaching in fact that atomic energy has effected the greatest change in that relationship since man's fall in the Garden of Eden. As part of his punishment man then lost that mastery over the forces of nature that had been part of his birthright. As a consequence he has had to struggle throughout the centuries for even that very small degree of mastery over the forces of nature which he has thus far achieved. Now, by the discovery of methods of unleashing the forces locked up in the nucleus of the atom mankind has suddenly taken a tremendous stride forward. By acquiring this new and revolutionary knowledge he has reached heights scarcely dreamed of even two decades ago.

Proper Use

In attaining these heights, however, he is faced with the deeply perplexing question as to the use to which his new knowledge shall

be put. It is an age-old question perhaps, but one that is intensified by the nature of atomic energy. For, used as weapon atomic energy could result in devastation and destruction of life on a scale beyond the power of man to survive. Used otherwise, it could bring about an era of material plenty beyond anything in man's experience. This is the choice before man today; this is the situation in which he finds himself in the atomic age.

As I have suggested the difference between this situation and that of man in the past is largely one of degree. The same immutable principles still govern his life, his purposes, and his destiny. The atom for all its awesome power is but a part of God's creation to be used to help man fulfill his purpose here on earth. The same fundamental problem confronts man in this age as in others past—the problem of the human will. As with past discoveries the same choice is before him; whether he shall use God's gifts for good or for ill, for the enhancement of his way of life, or his own undoing. The exercise of that choice is the fundamental problem of man in the atomic age just as it was the choice of the first man in the Garden of Eden.

Man's Nature

There are likewise two other fundamentals that have not been altered in the slightest by the advances of nuclear science. The first of these is man's nature. Whether he be primitive man first learning to control fire, or modern man attempting to understand and control thermonuclear reactions—whence come the energy of the sun and stars—he is still a creature of God. From that inevitable and fundamental truth he cannot escape. The atom has not changed man's need for faith except to intensify it; that man in his conquest of nature may be brought nearer to nature's God rather than be blinded by pride in his own accomplishments. If the unfolding of the mysteries of the atom—with all its fearsome possibilities—has emphasized one thing, it is man's utter dependence on God and the folly and presumption of dependence on self.

Just as man's nature remains unaltered, so, too, the Providence of God. Man's increased understanding of the nature of matter, however revolutionary it may appear to our limited vision, has come

about only by the consent and will of the Creator. And the atom, being of God's creation, is of itself good.

The problem before man is to learn how to adapt the good inherent in the atom toward a better life in the service of God. There are two aspects of this problem: One to forestall an all-out nuclear conflict with the consequent destruction of mankind, and the other, that of acquiring the knowledge necessary to utilize the power of the atom with optimum effectiveness. In solving both, the educational aspect is central. And this being an educational conference, it is appropriate to place emphasis there.

Educational Aspect

There is first an imperative need today for one and all in business and education, no less than in government, to know more of the facts of atomic energy and their implications for the future of the world. As we observe the international scene today in the light of the ever mounting stockpiles of nuclear weapons, and their ever increasing destructiveness, the indifference to these facts is inexplicable by any standard of rationality.

It is not by any means uncommon to find those who assume the inevitableness of war. The immoral aspects of despair implicit in such an attitude are matched only by the folly of indifference to an atomic future which is potentially darker than man has ever envisaged.

This indifference derives from a number of false notions. One is that the subject of atomic weapons is so secret as to preclude investigation by the general public. Another is that the subject is too profound for general understanding. Less excusable than either is the escapism of those who intentionally turn their minds away from this ugly subject so as to do away with its reality.

Admittedly there are aspects of atomic weapons which are necessarily secret. But the last few years have witnessed the disclosure of sufficient information to acquaint all who are interested with the essential facts.

Indifference

Whatever the causes, there has developed a peculiar form of indifference concerning atomic energy by which this, one of the cen-

tral facts of life today, would be left to the experts. As a result we now find both domestic and foreign policy being fashioned with insufficient understanding of those developments in atomic energy which ought to be reflected therein. This abdication to the experts, this suspension of the traditional functioning of informed opinion, this refusal to face the realities of atomic energy can be disastrous. The life of the human race is in unprecedented peril. This is a matter of the gravest concern to be understood by one and all, the public no less than those in whose hands is the direction of public affairs. Yet such understanding is by no means sufficiently widespread. In few places do I discern an adequate response to the realities of atomic energy. We continue to be involved in a race for armaments of destructiveness beyond the knowledge—even imagination—of those who have formulated the traditional concepts of war and foreign policy. It would, therefore, be a mistake to imagine that the solution to this race can be fashioned within the framework of those now outmoded concepts. Rather we must turn our minds to the task of finding solutions that adequately account for the realities of the present. But first these realities must be thoroughly understood. And this is primarily a matter of education.

Practical Proposal

It is not my purpose to outline a complete program whereby this education can be imparted. But there is one proposal that I would mention as a step in the right direction, and one that is urgently needed. It is a proposal that I have made before.

Let the leaders of the nations of the world witness the explosion of a large hydrogen bomb. Let them see modern warfare in embryo form before experiencing it in its ghastly totality. They would thus experience in a way that would leave them undamaged, save in their illusions, what modern war means in all its horror, in all its shocking destructiveness. It would make the political leaders of the world realize what war means in terms of thermonuclear weapons. Given this small glimpse of the modern meaning of the word war, there would, I am confident, rise in the world a reasoned horror of war, and a rational opposition to all policies that might lead thereto.

While thus seeking to avert atomic war, it is also incumbent on

us to strive to turn the same atomic forces into constructive channels. God, the creator of all things, brought these natural forces into being in order that they might serve humanity.

As you begin your Conference here tonight there is under way in Geneva what may turn out to be a landmark in the story of man's efforts to direct the atom along peaceful lines. The Geneva Conference is but a beginning. The full realization of our hopes will be attained when all peoples turn their minds and wills toward the peaceful development of this new force.

Need of Trained Scientists

If this objective is to be realized, there is need for an increasing effort in the basic sciences and in technology. One of the keys to this problem is the need for ever greater numbers of trained scientists—men dedicated to their work—but first dedicating their work to God. Here again it is a matter of education. In my over five years of service on the Atomic Energy Commission I am conscious that the scientific contributions which Catholics are making to nuclear research have not been and are not commensurate with their contributions in the fields of philosophy and the liberal arts. And this in spite of the tradition of the Catholic Church in the forefront of the sciences throughout the centuries.

The reasons for the situation I have mentioned are, no doubt, complex. Certainly, however, it is not because Catholic philosophy, or our Faith, is incompatible in any way with the truly scientific genius. Our Faith is based upon a recognition of the unity of truth. It tells men that man's supernatural destiny is the Beatific Vision, the Contemplation of Truth itself. Nor can it be that Catholic educators fear the unsettling effects of those speculative and practical methods and techniques which are characteristic of pioneer scientific thinking. On the contrary, such thinking should bring us nearer to Him Who called Himself the Truth. All this has been emphasized repeatedly by our Holy Father, Pope Pius XII.

To my mind the time is ripe for a renewed emphasis on the education of Catholic scientists. We must find and develop Catholic minds to participate in the discoveries now being made on the frontiers of science—discoveries which are shaking the philosophic foundations of materialism.

As I review the purpose and scope of this Franciscan Educational Conference I am encouraged to note that you recognize this problem. I am confident that these deliberations will be an important step toward the restoration of the great traditions of the Catholic Church in the teaching and development of scientists.

DISCUSSION

RHEINHOLD LINK, O.F.M.:—There is a remarkable concordance between Mr. Murray's address and an article written twenty-four years ago in the November fourth issue of *Commonweal.* In the course of an editorial evidently composed by Michael Williams the author is discussing "Mr. Edison and Science." He states: "His reflections on the subject of religion mirrored with quite uncanny accuracy the mind of his fellow citizen. Born and reared in surroundings to which God's existence was the most plain and sacred of facts, he faced the modern critique of theology with simple but honest bewilderment. He had to tell himself that the simple evidence upon which his generation had relied would not bear up under the attack of sophisticated criticism; and since he had no deeper philosophic or mystical experience, there was no weapon in his armory to do successful battle. And yet that something which remained human, beautifully mortal, in Edison and his time simply would not release the hold these men had on the fringes of Divinity. The attitude of their generation of Americans was always a forward-looking attitude: the feeling still abides within them that the purpose of the soul is, after all, not served by death. Science in the meaning of the time had obscured the glass through which they darkly apprehended, but there was still that which shone through, faintly, from beyond."

So far Mr. Williams thoughts can be said to refer in general to much that may be said during these days of the conference. But now comes the startling parallelism to one part of Mr. Murray's statement.

". . . But those of us who feel that God is active in human history and that He lets us find out what, from the beginning, He has ordained we should find, may well fear—this world alone seems correct—that we have been singularly indifferent to the true significance of technical civilization. After all, why have the mysteries which science has unveiled been revealed to our time? Is it not because—quite apart from the sociological necessities which have been in a measure provided by invention—the time was ripe for a new manifestation of the Divine plan? Science has added so much to man's insight into the world and its laws that the total effect is almost comparable with that of a barbarian chieftain's raid on a great city. Much must be done, years must pass, before the booty can so much as be sorted. Unless all signs fail, we are now entering a period during which this sifting and realigning will be a major concern."

NATURE, THE MIRROR OF GOD: TWO INTERPRETATIONS

Owen Bennett, O.F.M.Conv.

Is nature the mirror of God? We must distinguish, of course, in answering this question. The expression, "mirror of God," may be understood in many different ways, but for our present purpose we may reduce these ways to two: the expression may be understood *univocally,* or it may be understood *analogically.* Accordingly as the expression is understood in one or the other of these two ways there arise the two interpretations mentioned in our title. Nature regarded as a mirror of God in an *analogical* sense is the *terminus a quo* in all our reasonings in natural theology, if we are in the tradition of the perennial philosophy that found its first great expression in Plato and Aristotle and that grew to a rational perfection in the light of revelation, receiving its most complete treatment in the great systems of the thirteenth century. The same nature, regarded as a mirror of God in a *univocal* sense, has prompted vagaries of speculation on the nature of the divine, from Heraclitus and the ancient Stoics down through scores of "one-level" thinkers even to the present day.

In the present discussion I intend to review the basic characteristics of univocist temperament and the outstanding errors arising out of the ever-recurring tendency to regard nature as the univocal mirror of God. I shall endeavor, next, to point out the principles of the analogical approach in the light of which these errors are to be avoided. Finally, I shall make some brief application of this metaphysical discussion to the anxieties confronting the atomic age.

I

Basic Characteristics of the Univocist Temperament

The basic characteristic of the univocist temperament consists in this, that the univocist conceives of all reality at the same level. The

univocist does not consider that there may be grades of reality—degrees of being. He thinks of all that exists as existing in one way only.

Ordinarily the univocist conceives of all reality as existing on the level of his experience. There are exceptions to this, however: Parmenides, a univocist of the fifth century B.C., conceived of all reality as existing at the level of pure, unmixed being; and as a consequence he denied the reality of the objects of his experience insofar as they appeared to be multiple or undergoing change. But this was a rare exception; as a general rule the univocist judges and measures all reality strictly by the yardstick of the objects of his experience. Whatever exists, he thinks, exists in exactly the same way that the objects of his experience exist.

So long as the univocist remains within the discipline of the physical sciences he is not handicapped by his one-level type of thinking; for the physical sciences begin and end with the objects of experience. Hypotheses suggested by observation of the activities of the objects of experience are checked by experiments conducted with the same objects of experience. The mathematical aspects of physical theory have in more recent times advanced far beyond the limits of three-dimensional imagination; but this does not affect the essential nature of physical science. The trans-imaginable elements of physical theory are methodological in character. The hypothesis —or the theory—still requires to be checked through experiments conducted with the objects of experience. Physical science resolves its reasoning at the same level where it took its inception. Hence, the univocist, *qua* physical scientist, is not penalized because of his intellectual temperament.

It is only when the univocist begins to philosophize that his one-level type of thinking leads him astray. It leads him astray when he begins to inquire concerning the ultimate constituent principles of material things. Here he wanders into the baffling contradictions of dynamism and philosophical atomism. It leads him astray when he begins to inquire into the nature and principles of life, or of knowledge in general, or of thought and volition. Mechanism, materialism, sensism, behaviourism, etc., are all products of the univocist approach to questions that do not admit of a strictly one-level treatment. But the univocist courts speculative disaster most of all when

he begins to inquire concerning the ultimate source and reason of all things, and in this inquiry turns—as every such inquirer must—to nature, in order to find therein a mirror of God.

It would be a long business to treat, even in outline, all the varieties of error that have appeared as a consequence of the univocal approach to this most important of all inquiries. In this paper I shall limit myself to the consideration of two errors which may be termed "outstanding" because of their fundamental character: (1) the univocist error concerning the divine necessity; (2) the univocist error concerning the divine life and activity.

The Univocist Error Concerning the Divine Necessity

The univocist knows a certain necessity in the objects of his experience. He knows that the processes of nature take place with a strictly determined necessity. Certain causes being given, certain effects will necessarily follow. He knows, too, that the objects of his experience considered in their quantitative aspects are subject to mathematical necessity. Given a right triangle, the properties of such a figure necessarily follow.

Following his one-level type of thinking, he seeks for the ultimate ground of this physical and mathematical necessity in a divine necessity, conceived univocally in the likeness of this necessity of the objects of his experience. God also is a cause—the first cause. And since He is a cause of a certain nature, certain effects necessarily follow. The whole world of nature flows from God with the same necessity with which the mathematical properties follow from the nature of a right triangle.

The classic example—in modern times—of such strictly univocal reasoning about the divine necessity is to be found in the writings of Baruch Spinoza. Proposition XXXIII of the First Part of *The Ethics* reads as follows:

> Things could not have been brought into being by God in any manner or in any order different from that which has in fact obtained.

Spinoza offers the following proof of his proposition.

> All things necessarily follow from the nature of God (Prop. XVI), and by the nature of God are conditioned to exist and act in a particular way

(Prop. XXIX). If things, therefore, could have been of a different nature, or have been conditioned to act in a different way, so that the order of nature would have been different, God's nature would also have been able to be different from what it now is; and therefore (by Prop. XI) that different nature also would have perforce existed, and consequently there would have been able to be two or more Gods. This (by Prop. XIV, Coroll. 1) is absurd. Therefore things could not have been brought into being by God in any other manner, etc. Q.E.D.[1]

The consequences of this fundamental error concerning the necessity of God are all-embracing; for if God's causality is necessary with the same kind of necessity as that of physical nature or mathematics, then everything else is strictly necessitated. Spinoza draws out these consequences with great explicitness. He has shown, he says, "more clearly than the sun at noonday," that there is nothing to justify us in calling things contingent." When we use the word 'contingent' we are only revealing the imperfection of our knowledge. Everything is strictly determined; "for the existence of a thing necessarily follows, either from its essence and definition, or from a given efficient cause." [2] Again, he declares: "Whatsoever is in God's power must be comprehended in his essence in such a manner that it necessarily follows therefrom, and therefore necessarily exists.[3]

Thus the univocist mind removes all contingency—all freedom—from the universe, and from God Himself. Spinoza is at pains to state explicitly that God "does not act according to freedom of the will," and that "will no more appertains to God than does anything else in nature, but stands in the same relation to Him as motion, rest and the like, which we have shown to follow from the necessity of the divine nature, and to be conditioned by it to exist and act in a particular manner." [4]

All freedom in God and man being removed, all prayer—all acts of religion, become pointless. Strict fatalism is the only wisdom: what happens *must* happen, with an iron necessity which can neither be impeded or escaped.

What possible advantages can this type of univocist urge in favor of such a system? With grim satisfaction Spinoza speaks for his

[1] Rand, *Modern Classical Philosophers* (Boston, 1924), p. 162.
[2] *Loc. cit.*, note I.
[3] *Ibid.*, Prop. XXXV, Rand, p. 163.
[4] *Op. cit.*, Part I, Prop. XXXII, Coroll. II, Rand, pp. 161–162.

whole tribe. With the one stroke of the removal of freedom, he informs us, all of the vexing problems connected with freedom are removed: the possibility of freedom; the reconciliation of created freedom and divine omniscience; the permission of evil by an all-perfect God. These are difficult questions—questions irritating to the univocist temperament. These are problems which cannot be completely solved by human speculation, but which issue forth ultimately still cloaked in a great deal of mystery. And the univocist temperament will not tolerate mysteries. All must be clear and distinct. If freedom, and the use—and abuse—of freedom, are not things completely clear and distinct, then let freedom be denied, let it be univocally reasoned out of existence!

Spinoza proposes also the Stoic teaching that the acceptance of iron determinism helps us to master emotion. Fatalism having destroyed all desire, and having taught us submission to the necessary order of events, man is released from subjection to emotion—from the excessive desire of things beyond his attainment. Thus one arrives at the beatitude of resignation to fate—the perfect good, so far as Spinoza or any univocist fatalist can propose it.[5]

The Univocist Error Concerning the Divine Life and Activity

The determinism of nature and mathematics provided Spinoza with a univocal mirror of God which led him to a fatalistic theology and a grim stoicism in ethics. The univocist way of thinking leads other inquirers to a quite different error concerning the divine life and activity, an error that stands at the opposite pole from Spinoza's. This is characteristic of the views of God that appear when the mirror of nature is regarded univocally. One aspect of nature, so regarded, leads to a view of God that is quite irreconcilable with a view of God that is drawn univocally from another aspect of nature.

When certain inquirers turn their attention to the life and activity of the objects of their experience and regard this life and activity as a mirror in which to see a univocal reflection of the divine, they conclude to a theology that is evolutionist and indeterminist. In

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[5] Cf. Spinoza, *The Ethics,* Part V, Prop. II to VI, Prop. XIV to XX, and Note to Prop. XX, Rand, pp. 181–187.

Spinoza's philosophy everything is necessary, and everything is determined by a changeless fate; in these other philosophies everything is contingent and in a state of process or flux, and nothing can be foretold or forecast with any certainty—beyond the basic article of evolutionary faith, namely, that things will continue to evolve—for the better, of course. Examples of such philosophies are found in the systems developed in the early decades of the present century by S. Alexander, S. Pringle-Pattison, Lloyd Morgan and others—all of these thinkers drawing inspiration from the *elan vital* of Bergson.[6]

The evolutionary univocists begin—and ultimately end—with one level of life and activity which they know in the objects of their experience—an activity and life that involves change and process in its very essence. It is the organic life studies by the science of biology. The evolutionary univocist—or, as we may also term him, the biological univocist—never succeeds in conceiving life in any higher way than this lowest of all levels, the life of a material organism. Hence, when he looks upon nature as a mirror of God, and attempts to conceive the divine life and activity, he thinks of it as a life and activity that involves change and process. Here is an explicit statement of such a view by a biological univocist who declares that the new theology he proposes "involves the rejection of the idea of God as perfect in the sense that He is unchangeable. It looks obvious that what is perfect cannot change except for the worse. But even were that true, it does not justify us in saying that the impossibility of change or its absence is either a feature or a condition of perfection. Changelessness may be a ruinous condition. It is evidently a conception that is totally inapplicable to life in every form and at every stage. Life is constant self-creation. We are in some ways and in some degrees new beings every day; for the past constantly enters in us and becomes a part of us. The instant that process stops, death ensues: death *is* the stopping of a process. But it is also the substitution of another: decay sets in. As a matter

[6] F. J. Sheen, *God and Intelligence,* Part I, Chap. V, "The Modern Idea of God," pp. 47–61. Since then the only developments in philosophy that would have any bearing on the present topic have been negative—i.e., the various existentialist denials that nature is a mirror of God in any sense at all.

of fact, neither in the world of dead objects nor in the world of living beings can we find anything but process." [7]

Once you have removed changelessness from the notion of God several other consequences follow. God's perfection cannot be absolute. He must be in a state of development, achieving new perfections with the passage of time—for with the element of change in His nature He must exist in time, not in eternity.

H. G. Wells puts this notion of God's developing perfection in poetic terms. "If a figure may represent him, it must be the figure of a beautiful youth already brave and wise, but hardly come to his strength. He should stand lightly on his feet in the morning time, eager to go forward, as though he had but newly arisen to a day that was still but a promise. . . ." There is much more in the same vein.

The final paragraph of the chapter on the modern idea of God (Part I, Chap. V) of Sheen's *God and Intelligence* states succinctly the principal features of this God who is conceived univocally in the image of the organic light of nature.

> "The modern notion of God is on all sides that of an evolving God, who is either tending toward deity, budding off from the Divine Imaginal in one of the world systems, or else organic with a progressing world. He *is* not: He is *becoming*. His life is evolving with the cosmic order and is 'developing through the co-operative contributions (conscious and unconscious) of all creatures.' He is, therefore, helped by us, and without us would for ever remain unachieved. He 'needs not our prayers, our incense or the easy homage of our lips, but our brain, our blood, our will, our life.' Ay, more than this, 'God Himself, in short, may draw vital strength and *increase of very being* from our fidelity.' " [8]

In one point the biological univocist agrees with Spinoza, i.e., in the removal of the problem of evil. Spinoza removes it by denying divine freedom. The biological univocist removes it by denying the absolute, unchanging character of divine perfection—in effect, by denying God's sovereignty and making him a product of evolution along with everything else in the world. God is not responsible for evil for the simple reason that He is powerless to prevent or impede it, or do anything about it.

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[7] H. Jones, *A Faith that Enquires*, pp. 359 (quoted in Sheen, *op. cit.*, p. 50).
[8] Sheen, *op. cit.*, p. 61.

II

Principles of the Analogical Approach

The analogical approach recognizes the relation of thought to experience, and the extrinsic dependence of intellect on sense. We must form intellectual concepts according to the measure of our experience in the sense that *we can only conceive univocally* what we can represent at the level of sense experience. The proper object of our intellect in its present state is the being of material things. But we can form *analogical* concepts of things that exist in a mode higher than that of the objects of our experience.

The idea of being, and the first judgments about being, provide the objective light in this formation of analogical concepts. Our intellect is orientated to being insofar as it is an intellect (even though it is limited to the univocal understanding of material being insofar as it is a human intellect *in statu viae*). In our experience we do not find being, pure and simple; yet our intellect is always seeking being, pure and simple, absolute and unlimited—in the fullness of its nature as being. Our intellect seeks this absolute being as the ground and source of the things of experience in its insistent inquiry for the efficient cause. Our intellect seeks the same absolute being as the ultimate good or reason of the things of experience in its connatural search for the final cause or purpose. The ten conditional inferences of St. Bonaventure (in his proof from the world of nature), the five ways of St. Thomas Aquinas, the threefold order of primacy established by Duns Scotus—all are approaches to the knowledge of God conceived analogically in the light of the natural orientation of our intellect to absolute being. (When we have understood this—i.e., after we have gone through the a posteriori proofs —we can see, with St. Bonaventure, the perfect proof for God's existence in the idea of being.)

Orientated though it is to the absolute being, our intellect nevertheless cannot outstrip the limits of its present condition. We must form our analogical concepts of the transcendent divine being through our univocal concepts of material things—through our concepts of the objects of our experience. At the same time, we must guard against the univocist error of confusing the limited mode of

our understanding with the mode of existence of the absolute being Whom we know by way of analogy. This is the balance we must maintain if we would study nature as a valid mirror of God. For to say that we know anything analogically (and we mean here, of course, according to the metaphysical analogy of being), is to say that we know it to exist in a manner higher than we can univocally understand. In order to think of it, then, we must: (1) Affirm of it the perfections of being which we discover in the objects of our experience. (2) Deny by a corrective judgment the limitations proper to the mode of being of the things of our experience. (3) In the case of our knowledge of God, the absolute being, we must affirm by a completing judgment the realization of the perfections of being without limit or restriction of any kind. This is the traditional triple way of affirmation, negation, and transcendence.

These analogical concepts, although they are far from perfect knowledge, are nevertheless very precious since they enable us to speak significantly of God and predicate of Him perfections which pertain properly to Him; even though our univocal understanding of these perfections is limited to the mode which is proper to the things of our experience. The point is that the analogical concept enables us to rise above *metaphor* when speaking of God. We speak in metaphor of God when we apply to Him names that carry limitation and imperfection in their very signification—names or terms like "anger" or "finger" or "breathing" or "repenting," etc. These terms apply primarily to creatures and are said of God only secondarily and improperly. But we rise above metaphor whenever the term we use is a term that carries no necessary or essential limitation or imperfection in its signification. These terms apply primarily to God, and signify perfections which are found in their fulness only in Him, and which are only imperfectly shared or participated by creatures—especially the creatures of our very limited experience.

Necessity, activity and life are terms signifying perfections of this latter kind. Nature may serve as a mirror reflecting these perfections of God only if we remember that in nature, necessity, activity and life are only imperfectly participated, and reflect the divine perfections only in the manner that the limited can reflect the unlimited, only in the manner that the composite and multiple can reflect the perfectly simple and perfectly unified, only as that

which comes to be and passes away can reflect that which perfectly and unfailingly *is*.

Analogical Approach to the Divine Necessity

God is absolutely necessary; for, since His very nature is unlimited and unrestricted being, He must exist and must be the perfectly unified realization of every unmixed perfection—truth, goodness, beauty, wisdom, love, justice, mercy. All of these perfections must be formally present in an unlimited mode in the divine being without prejudice to the divine unity and simplicity.

God must will and love His own perfection with an absolute necessity. Yet this necessity by which He wills and loves his own goodness and perfection contains all the perfection of liberty; for He wills Himself not by any constraint or blind determination, but with all the gladness, devotion, generosity and dedication of infinite spirit, knowing Himself and His infinite lovableness with infinite comprehension.

Willing His own infinite being and goodness with absolute necessity that also comprises the highest realization of liberty, God's will is necessitated to nothing else. For all that exists besides God exists only because it participates and reflects the divine perfection in some particular way. God wills such participations to exist since it befits His goodness to commuincate some share of His perfection to others. All things other than God exist in order to show forth some limited reflection of the divine perfection, and—in the case of rational creatures, men and angels—to have some created share in the knowledge and love of God's perfections: in the supernatural order to share in God's own life by knowing Him and loving Him as He knows and loves Himself. Thus all that exists, other than God, must exist as directed to God. Things can exist only if God is their ultimate end. Now things ordained to an end outside themselves are not willed necessarily unless the end cannot exist without them. But the divine perfection is what is necessarily, with or without creation. Hence God wills nothing without absolute necessity beyond Himself. Hence all creation is willed by God with sovereign freedom.

The sovereign freedom with which God wills all creation is a freedom transfused with infinite wisdom, power, justice, mercy. (These

truths, deducible from the perfection of the divine being and evidenced in creation, are manifested more perfectly through divine revelation—especially the revelation of the incarnate Word.) The sovereign freedom of God and the divine wisdom lead all creatures to their end, supplying all that is fitting to their natures and their condition. To some of His creatures God grants a nature that is determined in its mode of activity; to others He grants intelligence and freedom to seek their own end. All of His creatures are subject to His providence, but the latter in a special way. God's providence envisages the permission of evil, both physical and moral, but only because in His infinite wisdom and power He is able through such permission to being about a greater good.

Guided by such reasoning conducted in the light of the principles of the analogical approach, the necessity of God is seen to be a necessity infinitely transcending the blind necessity of nature. This latter reflects, most imperfectly, the absolute necessity with which God wills Himself and His own goodness; but unless it is understood analogically it hides much more—infinitely more—than it reveals, and leads to a fatalistic, deterministic travesty of the absolute necessity of the divine perfection.

Analogical Approach to the Divine Activity and Life

It is likewise with the consideration of the divine activity and life. God is not only active: He is activity—pure activity. He is the activity of infinite wisdom, "more active than all active things," reaching "from end to end mightily" and ordering "all things sweetly." [9] God is the pure act that must be at the origin of all other activity involving change. His activity is the most perfect life—the life of pure intelligence, whose self-containedness—or immanence—we can appreciate even now in some measure, if we do not tie our thinking about life down to the level of the vegetative—to the level of the material organism.

The activity of the divine life embraces in an ever-present eternity all the past, present and future that comes to be or passes away in time—all the succession of thoughts and affections that belong to the world of created spirits. All that is lost to the past

[9] *Wisdom,* vii, 24; viii, 1.

through the ephemeral chink of the present in the ever-changing world of time is kept in ever-present permanence at the level of infinite and perfect activity in God's life. The eternal divine life—ever fresh, ever novel—has in it all that is desirable and valuable in progress, but in the immeasurable mode of infinite spiritual fruitfulness, and infinitely holy commitment and dedication. God's life is that perfect life of unchanging intensity, out of whose virtuality flows all the vast world of created spirit and matter in its broad extent and its endless variety and detail of design; although a thousand such worlds would not begin to exhaust the divine power, which is inexhaustible by any creation.

Thus do we think and speak of the divine life and activity in the light of the principles of the analogical approach. Again—as with the divine necessity—the divine life and the divine activity are mirrored in the world of nature, but as in an analogical mirror not a univocal one. The tremendous energies locked in the nuclear heart of material substance, the cosmic energies and the processes resulting therefrom, the rush of stars and galaxies, the circling of planets, the orderly procession of seasons and the growth and fruitfulness of living things, all of this is a revelation in material terms of the divine activity and life that has devised and produced and maintains the whole visible universe, but a revelation that veils infinitely more than it makes manifest if it is approached in a univocist frame of mind. Only by the analogical approach can we surpass the limits of imagination and recognize, in the infinite reach of metaphysical insight, that all this material activity and life is literally as nothing compared to the infinite life of wisdom and love whence it has derived its origin.

III

Application to Anxieties of the Atomic Age

Now to apply the points of this metaphysical discussion to the anxieties confronting this atomic age. In the atomic age the danger of falling into univocist errors concerning divine necessity and divine activity and life is greater than ever, for the simple reason that the human mind is very greatly impressed by the sheer quantitative

proportions of nuclear energy and its availability for humanly directed destructiveness or productiveness.

The blind necessity of physical force on such a terrifying quantitative scale, capable of bearing directly on human activity and human security and happiness, is something so immediately and disturbingly impressive that the mind is almost unbalanced by it. In its destructive aspects especially, the imagination is so affected by the dreadful magnitude of nuclear power, that unless the doctrine of Christian philosophy on the analogical approach to the understanding of the divine necessity and freedom and providence is repeatedly proposed and explained, there is a great danger of a new popular wave of fatalism and determinism, an ever-increasing danger of the popular mind passing univocally from the dreadful necessity of material force to the necessity of a God conceived along Spinozist lines. The prevalence of fatalism and determinism would constitute one of the greatest of all dangers in the atomic age, for such a philosophy in the speculative order leads to moral and political paralysis in the practical order.

On the other hand, if the efforts of the world's statement are successful, and if the new resources of atomic power are diverted from violent uses and directed to the material benefit of human society, the resulting material prosperity will bring along with it a new and increased temptation to a belief in inevitable progress and evolution, and to a univocally conceived notion of a God who is not to be worshipped as sovereign or thanked for His goodness and bounty but who is "doing fine" with the rest of the biologically evolving universe of which He is merely a decorative part.

Against such an eventuality we must labor perseveringly, not—certainly—to prevent the direction of atomic energy to peace-time uses, not to prevent material prosperity, but to counteract the intellectual aberrations associated with such a temporally blessed condition; we must labor to show—not merely as speculative and detached thinkers, but as Christians and Franciscans—that there is a life and activity higher than material activity and the life of the body, a life that we may approach analogically through the ascending levels of its created reflections, as through analogical mirrors: the mirrors of external nature, of sentient consciousness, of rational knowledge and love, and of the supernatural life of grace

—the highest and closest analogical mirror of all, since it is a created participation in the perfect life itself—the infinite ocean of life Who is God.

DISCUSSION

AIDAN M. CARR, O.F.M.CONV.:—Father Owen's paper serves to pinpoint the theme of this year's FEC: in what way is modern man to conceive the material world about him as an outpouring of divinity's power and wisdom? To a very large extent, the well-being (even the survival) of contemporary mankind depends upon what conception we do adopt of the meaning of creation in terms of a Creator. Our distinguished contributor of this year: Mr. Thomas Murray, has told us that he believes that God "meant us to find the atom. Admittedly, we are wrestling with the greatest alteration in man's relation with Nature since the upheaval at the time of the Garden of Eden. But his fundamental relation with God has not changed one whit. The same trial that tested the first man in Eden, and every man since, challenges us in the atomic problem. It is the exercise of choice, the dangerous freedom to use God-given power for good or for evil."

This is a clear-cut denial of determinism, and it is reiterated by Father Owen in a more directly metaphysical frame: ". . . for such a philosophy (determinism—fatalism—necessity in the Spinoza sense) would constitute one of the greatest of all dangers in the atomic age, for such a philosophy in the speculative order leads to moral and political paralysis in the practical order." We might add that it leads to moral anarchy and to political slavery.

It is a matter of tremendous importance to bear in mind that the philosophical directions given men by gifted thinkers—such as Spinoza—do have very concrete impact on reality. That is the awful responsibility of the philosophers. The pleasantries of Voltaire, some one has observed, and his calumnies are still used, but the thought of Spinoza continues to inspire whatever is scientific and living in contemporary irreligion.

Of course, Father Owen, in his employment of Spinoza, intended simply to use him as perhaps the most striking exponent of the philosophy of the univocist, as indeed he is. The danger of Spinoza's thought is inherent in any approach to reality that ignores analogy.

It is interesting and perhaps profoundly significant that Spinoza does not appear to have known the great philosophers of Scholasticism—at least not directly. His Latin was used for physical and mathematical studies. His philosophy readings were largely restricted to the writers of the Renaissance (and they doubtlessly vastly influenced his trend of ideas, especially Giordano Bruno). He was oriented also by Descartes, and attributed to this French intellect a great measure of his knowledge.

Certain specific fields of Spinoza's thought which are pertinent to the theme of this discussion are these:

Metaphysics—Spinoza held that substance is endowed with an infinity of infinite attributes—it is unique—it is God and it is all. His interpreters dispute as to whether he meant by this to identify substance with God, or if, on the contrary, he held for the possibility of a plurality of substances, and by de-

duction one arrives at the unicity of substance and so its identity with God. The second likely is the more tenable interpretation.

Morality—Morality was the unique object of Spinoza's philosophy: "the soul and its sovereign good." To determine what is good, one would have to consider the point of view of *nature* and the point of view of *reason*. From the point of view of nature each thing is as good as it can be, since it is determined by the laws of being, and as a corollary of this, one can do whatever his potencies extend to. But from the point of view of reason, considering the entirety of things, things are more or less perfect, according as they are a source of joy. God is the sovereign good, and it is by reason that we attain to Him. Reason, seeing the consequence of our own acts, dictates the practice of virtue. Also, comprehending things under the aspect of laws of universal necessity—knowing things under the form of eternity, it finds joy in this adequate knowledge: *amor intellectualis Dei*.

Religion—The right of the state is without limit: Life according to nature precedes life according to reason, both in principle and in the temporal order. The laws of nature are wider than the laws of religion in their domain. Therefore the sovereign can overrule the subjects of his realm in the matter of religion. But—contrary to Hobbes in His *Leviathan* (Hobbes knew only the law of nature)—Spinoza admitted the interior liberty of the life of reason.

In his presentation of the thought of Spinoza on the meaning of nature and of God, Father Owen has indicated the dreadful possibilities of a philosophy such as Spinoza defends. In the age of the atom there is no room for a philosophy which denies the meaning and consequence of analogy in human thought.

ST. FRANCIS' ATTITUDE TOWARD CREATURES

Leander Blumlein, O.F.M.

Francis of Assisi as a lover of creatures has become a commonplace in the world's art, whether painting, sculpture, music or literature. Yet precisely in that role Francis is frequently and seriously misunderstood. Well-meaning devotees sometimes draw a picture of a romantic humanitarian, a soft, though attractive, sentimentalist. Why? Because such re-creators tend to isolate Francis' love of nature, separate it from the total outlook of Francis the man. In their efforts to appreciate his attitude toward creatures they force Francis into a pattern of a nature-lover, rather than fit his love of nature into the whole pattern that was Francis himself.

What, then, is the way toward a proper understanding of Francis? Surely one must proceed from the solid basis of supernatural faith and Christian dogma and truth. Francis was always the *vir catholicus,* rich in grace and filially attached to the Church and its teachings. Any structure he would raise would necessarily rest upon that foundation.

However, assuming such a supernatural basis of faith and dogma for Francis' outlook, we might pose a further question for the purposes of this paper: Is there some way of our getting inside Francis himself, as it were, and seeing all things, Creator and creatures, through his eyes? Can we somehow share Francis' *Weltanschauung* with him? More pointedly, is there one quality or attitude which, if we grasp it, will give us at least the foundation of the over-all pattern of Francis' outlook? Yes, there is, and it is reverence.

If we accept reverence as the psychological basis of unity in Francis the man, we will find in it the master key to a fuller understanding of why and how he loved creatures, of why and how movements and acts of love sprang forth so spontaneously from him toward all things good. We can find in the concept also the beginnings of a Franciscan approach to science. And more, if we catch

that spirit of reverence ourselves, it can point the way toward a fuller and warmer appreciation of Francis and his whole movement.

I

Reverence

If reverence is to be our key to an understanding of Francis, we must first answer the question: What is reverence? Dietrich Von Hildebrand offers a definition in his book *Liturgy and Personality:*

> . . . reverence is a response to the general value of being as such, to the dignity which all being possesses as opposed to nothing or to mere fictitiousness, to the value of its own consistency, of standing on its own, of the ultimate "positivity" of being.[1]

Reverence, therefore, presupposes a recognition of the value of being in itself, apart from any ulterior end a being might serve. And there lies the heart of the problem and the difficulty for us moderns. Because we have grown so accustomed to being "practical," utilitarian and (unwittingly) selfish, we have lost sight of the value of being as such. What is a thing good for? How can it be used? How can it serve me or mankind? We readily ask such questions and ignore the prime question: What is it? Aware of this situation, a whole gallery of present day Christian thinkers stress the all-important idea that things are of value first of all in themselves. To a few of these thinkers we turn briefly for a clearer understanding of this necessary premise.

a. *Meaning* and *Purpose*

Romano Guardini blazes the path by drawing the distinction between meaning and purpose. All things have meaning, he tells us, though not all things have purpose.[2] Of the two, meaning is by far the more important.

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[1] Dietrich Von Hildebrand, *Liturgy and Personality* (N. Y.: Longmans, Green and Co., 1943), p. 58.

[2] "Objects which have no purpose in the strict sense of the term have a meaning. . . . Measured by the strict sense of the word, they are purposeless, but still full of meaning." Romano Guardini, *The Spirit of the Liturgy.* Trans. Ada Lane. (N. Y.: Sheed and Ward, reissued, 1935), p. 174.

In so far as a being has purpose it is subordinated to something else. It serves another being in some way, exists for that other being and derives value from it. Thus a pencil serves one to write, a saw to cut wood, a slave to do his master's bidding.

> That which we call purpose is, in the true sense of the word, the distributive, organizing principle which subordinates actions or objects to other actions or objects, so that the one is directed towards the other, and one exists for the sake of the other. That which is subordinate, the means, is only significant in so far as it is capable of serving that which is superior, the end.[3]

Regardless of its purpose, and even in the absence of a purpose, everything has meaning. Its meaning is simply to be itself, that it should be and by its very being glorify God who brought it into existence. Its meaning stands apart from any relation the thing may also have to some other created object.

> Now what is the meaning of that which exists? That it should exist and should be the image of God the Everlasting. And what is the meaning of that which is alive? That it should bring forth its essence, and bloom as a natural manifestation of the living God.[4]

Therefore each thing, whether or not it have purpose, is vested with a dignity not dependent upon its use nor upon its benefits or service to others but simply upon its being. "Purpose is the goal of all effort, labour and organization, meaning is the essence of existence, of flourishing, ripening life." [5]

Gerard Manley Hopkins grasped this vision well in the "inscapes" he observed. He realized that "There lives the dearest freshness deep down things," [6] and made it a frequent theme of his poetry. Nowhere does he state it more expressly than in the sestet of a sonnet:

> As kingfishers catch fire, dragonflies dráw fláme;
> As tumbled over rim in roundy wells
> Stones ring; like each tucked string tells, each hung bell's
> Bow swung finds tongue to fling out broad its name;

[3] *Ibid.*, p. 172.
[4] *Ibid.*, p. 174.
[5] *Ibid.*, p. 175.
[6] Gerard Manley Hopkins, "God's Grandeur," Poems of *Gerard Manley Hopkins*, ed. W. H. Gardner (N. Y.: Oxford University Press, 3rd ed., 1948), p. 70.

> Each mortal thing does one thing and the same:
> Deals out that being indoors each one dwells;
> Selves—goes itself; *myself* it speaks and spells;
> Crying *Whát I dó is me: for that I came.*[7]

In relation to meaning, then, reverence might further be defined as the proper or adequate response to the meaning of a thing. Since the inherent value of anything is in direct proportion to its being, a thing will elicit a greater or lesser response according to the nature of its being. In giving reverence, therefore, one must first grasp the nature of the object, and then pay a *meaningful* response.

b. *Man of Vision—Man of Power*

Fr. Gerald Vann, O.P., in *The Heart of Man* carries the implications of reverence a step forward by distinguishing between the man of vision and the man of power. The man of power desires to have, to use, to rule independently of everyone and everything not himself. He desires mastery and determines to acquire it at the cost of any violence, by grabbing, smashing, even killing if necessary. He is wholly wrapped up in a world of purposes. The man of vision, on the other hand, is concerned primarily with meanings, with knowledge of and appreciation for things as they are, and in using them he respects their nature. Paradoxically, Fr. Vann indicates, the man of vision is the real man of power, the true master, while the would-be man of power is powerless. The man of vision is a true lover, for he values things for what they are; the man of power is a false lover, for he seeks only himself and his good in things. An example from Fr. Vann will illustrate the point well:

> We all know the difference between the carpenter who is really an artist and the man who can knock a bookcase together if he needs one. There is no doubt which of the two is master and maker; you watch with admiration the almost miraculous obedience of tool and material to the craftsman's will. But you notice that it is not he who asserts with every gesture his will to dominate; it is the hedge-carpenter who wrenches and forces and blusters and drives the wood to obey him against the grain. There is no great art without reverence. The real carpenter has great technical knowledge of material and tools; but the bungler might conceivably have that and still be a bungler. The real carpenter has some-

[7] *Ibid.*, p. 95. Italics are the author's.

> thing much more: he has the feel of the wood, the knowledge of its demands is in his fingers; and so the work is smooth and satisfying and lovely because he works with reverence that comes of love.
>
> Apply this to any form of making, apply it to the way men treat animals they have care of, apply it to the relationship of men with men; always it is the lover and servant who is most the master and who seems to have magic spells at his command . . . remember that reality is not a nettle to be grasped, or a fruit to be plucked and eaten, but a bride to be wooed.[8]

The man of vision, because he is alive to meanings, is always the true man of power. He respects or reverences the nature of a thing, works with it rather than upon it, cooperates with it rather than forces it, and the thing in turn responds to the touch of his hand. What Fr. Vann is stressing is simply this: reverence, a loving response to the value of being, begets in turn a response from the being.

Attitude of Reverence

Up to this point we have been dealing with the concept of reverence. An intellectual concept, however, must remain ineffective as a pattern of life unless it become an intellectual habit (if we may use the term in that way), a *principium agendi,* a mind set, an outlook—in this case, an habitual attitude of reverence. What are some of the implications of such an habitual attitude?

a. *Leisure*

Something of such an attitude of reverence is included in what the German philosopher Josef Pieper calls "leisure." Contrary to what we so often mean by the term, leisure is not to be understood as idleness, or simple non-activity. Nor does idleness itself imply non-activity. Rather, according to Pieper's understanding, idleness is what the medievals meant by *acedia,* a vice which St. Thomas regarded as a sin against the third commandment since it prevents one from having "the peace of mind in God." [9] *Acedia* signifies

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[8] Gerald Vann, O.P., *The Heart of Man* (N. Y.: Longmans, Green and Co., 1945), pp. 9–10.

[9] Josef Pieper, *Leisure: the Basis of Culture.* Trans. Alexander Dru (N. Y.: Pantheon Books Inc., 1952), p. 50.

> that a man does not, in the last resort, give the consent of his will to his own being; that behind or beneath the dynamic activity of his existence, he is still not at one with himself, or, as the medieval writers would have said, face to face with the divine good within him; he is a prey to sadness (and that sadness is the *tristitia saeculi* of Holy Scripture).[10]

Idleness may (and generally does) beget a furious activity, a hurly-burly existence, an eagerness to grab hold of and meddle with everything, to actively intervene with things and never let them unfold. It is characteristic of the man totally engulfed in the world of purposes, the man of power, the would-be master.

Leisure, on the other hand, is the opposite of idleness thus defined.

> It is man's happy and cheerful affirmation of his own being, his acquiescence in the world and in God—which is to say love[11] . . . an attitude of non-activity, of inward calm, of silence; it means not being "busy," but letting things happen . . . there is also a certain happiness in leisure, something of the happiness that comes from the recognition of the mysteriousness of the universe and the recognition of our incapacity to understand it, that comes with a deep confidence, so that we are content to let things take their course. . . .[12]

But leisure, Pieper adds, is not simply non-activity; it is foremost an attitude of contemplative celebration.

> God, we are told in the first chapter of Genesis, "ended his work which he had made" and "behold, it was very good." In the same way man celebrates and gratefully accepts the reality of creation in leisure, and the inner vision that accompanies it. And just as the Holy Scripture tells us that God rested on the seventh day and beheld that "the work which he had made" was "very good"—so too it is leisure which leads man to accept the reality of the creation and thus to celebrate it, resting on the inner vision that accompanies it.[13]

Thomas Merton frequently writes of the same spirit, though not under the same term. In *Seeds of Contemplation* he says:

> Untie my hands and deliver my heart from sloth. Set me free from the laziness that goes about disguised as activity when activity is not required of me, and from the cowardice that does what is not demanded, in order to escape sacrifice.
>
> But give me the strength that waits upon You in silence and in peace.[14]

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[10] *Ibid.*, p. 49.
[11] *Ibid.*, p. 50.
[12] *Ibid.*, p. 52.
[13] *Ibid.*, p. 55.
[14] Thomas Merton, *Seeds of Contemplation* (Norfolk, Conn.: James Laughlin, 1949), p. 36.

In accord with the nature of his book, Merton sees such an attitude of leisure fructify in contemplation. Moreover, he stresses a further notion necessary to our approach to things, namely, the gift-character of every created being and the ensuing response due it.

> The situation of the soul in contemplation is something like the situation of Adam and Eve in Paradise. Everything is yours, but on one infinitely important condition: that it is all *given*.[15]
>
> . . . . . .
>
> For all God's gifts there must be in us a response of thanksgiving and happiness and joy: but here we thank Him less by words than by the serene happiness of silent acceptance.[16]

Leisure, therefore, implies a recognition of the mystery of things and their acceptance as gifts. Faced with mystery and gift one must not attempt to grab hold, to lay open, to use merely; one must rather respond with reverence, stand aside, as it were, and let things unfold themselves. Then in leisure, with its contemplative approach to everyday reality, the habitually reverent man will necessarily acquire a spirit of childlike wonder.

b. *The Spirit of Discretio*

Closely related to the attitude of leisure, perhaps even a part of it, is what Dietrich Von Hildebrand calls the "spirit of *discretio*." It is "a sense of the dramatic rhythm of being," a sense of "the law of inner development of all things, which varies according to the sphere of being," an appreciation of the fact that "everything requires its own time of inner ripening in order to be genuine and true."[17] The spirit of *discretio* might be considered a willingness to let things mature, a holy patience while being unfolds.

A person lacking such a spirit can only bungle in his approach to things. In his irreverent craze for efficiently accomplishing his purposes, in his haste to "get things done," he will do violence to the nature of things and must ultimately end in failure. He will, for example, sand a varnished surface before it is dry, pick the fruit before it is ripe, jump to a conclusion before understanding the

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[15] *Ibid.*, p. 148.
[16] *Ibid.*, p. 150.
[17] Dietrich Von Hildebrand, *op. cit.*, pp. 140–41.

implications of a premise, set out to convert the world before he himself is grounded in the faith. In other words, not grasping the meaning of things and being totally concerned with purposes, he will never give serious response to the value of being as such; the spirit of leisure will be impossible; and in his superficial, selfish, domineering approach to things he will never win their response. The most he can erect is a seemingly solid structure, but one built on sand, an unstable, shifting *Weltanschauung* at best, because he lacks the spirit of reverence.

II

Such, then, are the nature and implications of reverence, the quality which we assume as the psychological basis of unity in Francis the man. It remains for us now to see that attitude at work in Francis himself.[18]

Francis, a Man of Reverence

In looking at reality with Francis, the man of reverence, we turn first to God.

a. *Toward God*

Francis, a *vir catholicus,* saw God at the center of all things. Wherefore, life (and all reality) in spite of its apparent complexity was basically simple. And what was God to Francis? Surely He was the Supreme Being, with all the attributes listed in the theology books—simplicity, immutability, eternity, immensity, ubiquity, infinity and unity. Francis' grasp of these truths inspired his own warm version and response in his *Laudes Dei.*

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[18] Citing a number of twentieth century authors, none of whom would be listed among "Franciscan writers," as the groundwork for understanding Francis of Assisi, and even seeing in him an exemplification of their ideas, may seem strange. One might, of course, recall the fact that these authors are simply expanding Christian principles of which Francis, as the "radical Christian," would be the embodiment. Our surest justification, however, in this procedure is the fact that some of these authors themselves refer to Francis implicitly or explicitly as an example of their concepts in action. For example, cf. Dietrich Von Hildebrand, *op. cit.,* pp. 25, 33, 123.

Thou art holy, Lord God, who alone workest wonders.
Thou art strong. Thou art great. Thou art most high.
Thou art the almighty King, Thou, holy Father, King of heaven and earth.
Thou art the Lord God, Triune and One, all good.
Thou art good, all good, highest good, Lord God, living and true.
Thou art charity, love.
Thou art wisdom.
Thou art humility.
Thou art patience.
Thou art security.
Thou art quietude.
Thou art joy and gladness.
Thou art justice and temperance.
Thou art all riches to sufficiency.
Thou art beauty.
Thou art meekness.
Thou art protector.
Thou art guardian and defender.
Thou art strength.
Thou art refreshment.
Thou art our hope.
Thou art our faith.
Thou art our great sweetness.
Thou art our eternal life, great and admirable Lord God almighty, merciful Saviour.[19]

For Francis, then, God as the highest of all beings, held the highest of all values, and was therefore worthy of the highest response. Francis gave that response in the simple spirit of the *Gloria's* "We praise Thee. . . . We adore Thee. . . . We give Thee thanks for Thy great glory."

b. *Toward All Creation*

God, Francis knew, is not only the Supreme Being; He is also the Creator and Lord of Creation. In His goodness God willed that there be other beings to glorify Him by their existence, and in that act of willing there came forth out of nothing angels, the firmament, the earth, plants, animals and men. God looked at all things and saw them good. He continues to quietly contemplate them in this seventh day of rest.

[19] Hilarin Felder, O.M.Cap., *The Ideals of St. Francis.* Trans. Berchmans Bittle, O.M.Cap. (N. Y.: Benziger Bros., 1925), pp. 411–12.

And so also Francis. He took time to *consider* the lilies of the field, to contemplate them for what they are, things gifted by God with existence and glorifying Him by that existence. Francis did not search them out merely to pluck and use them. He was willing to expend leisure, to "waste time for the sake of God" as Fr. Guardini puts it,[20] to forget purposes for a moment and regard the meaning of things in themselves. Therefore, to borrow the phrase again, he could perceive "the dearest freshness deep down things." The value of created things lay in their existence, and to that he responded with proportionate reverence.

c. *Toward Nature*

To look at creation only "in general" is an impossibility. We see concrete, individual things. In doing so we notice the great variety in nature, a variety of genera subdivided into a greater variety of species which in turn embrace a multiplicity of varied details. Why such variety? "Things could be so much more simple," observes Fr. Guardini.[21] Why not just "trees" instead of oaks, maples, elms? Why not every leaf and branch identical with every other? With even a much narrower variety the same practical purposes could be served. But there still remains the question of meanings.

Each individual thing is a good in its own way, glorifying God by the splendor of its individuality, by its own existing essence. Each thing has its own particular meaning and value in being *this* star, *this* bud, *this* leaf, *this* bird. Or, as Thomas Merton has it:

> Therefore each particular being, in its individuality, its concrete nature and entity, with all its own characteristics and its private qualities and its own inviolable identity, gives glory to God by being precisely what He wants it to be here and now, in the circumstances ordained for it by His Love and His infinite Art.
>
> The forms and individual characters of living and growing things and of inanimate things and of animals and flowers and all nature, constitute their holiness in the sight of God.
>
> Their inscape is their sanctity.[22]

Francis seems to have had a singular appreciation for things of

[20] Romano Guardini, *op. cit.*, p. 183.
[21] *Ibid.*, p. 173.
[22] Thomas Merton, *op. cit.*, p. 25.

nature which would express itself at the most unpredictable moments and in the most unexpected ways. We recall the time when he would not permit Brother Fire to be extinguished, even though it was burning his habit. He would carefully lift a worm off the path lest it be crushed by passers-by. When cutting trees the brothers were bidden not to destroy them entirely so that they might have a chance to grow again.[23] A sentimental fool, one might be tempted to call Francis here, and so would he have been had purposes alone been guiding his judgment of values. However, posit an appreciation of meanings, a vision of things as good because they are being and doing what they were meant to be and do, and we begin to see reason behind such "madness." Because Francis was so alive to meanings, his enthusiasm for things was always fresh and his response to them genuinely spontaneous.

Nowhere is Francis' enthusiasm more strikingly shown than in his *Canticle of the Sun.*

> Praised be Thou, my Lord, through all Thy creatures,
> especially through our honored Brother Sun
> who makes the day and through whom Thou givest
> us light; he is beautiful and radiant with great splendor,
> and a sign, O Most High, of Thee.
>
> Praised be Thou, my Lord, through Sister Moon and
> the stars formed in the sky, clear, precious and fair.
> . . . . .
> Praised be Thou, my Lord, through Sister Water,
> who is useful and humble, precious and chaste.
> Praised be Thou, my Lord, through Brother Fire,
> by whom Thou dost illumine the night;
> beauteous is he and gay, mighty and strong. . . .

We note how Francis is first of all concerned with the sun as shining, with water as being water, with fire as burning, and not with the value of the sun as giving him, Francis, light to go about his work, nor with water as quenching his thirst, nor with fire as cooking his food or giving him warmth. The sun does "give us light," the water is "useful," and fire does "illumine the night," but Francis' primary stress falls upon this, that God be praised (glorified)

[23] Hilarin Felder, O.M.Cap., lists these and other like incidents, *op. cit.*, pp. 419 ff.

through or by means of these things' being and doing what God meant them to be and do, and in that being and doing serving us. The canticle is before all else a song of praise and, except in the sense of "We give Thee thanks for Thy great glory," only secondarily and incidentally a song of thanksgiving for utilities given to us. Such a distinction is necessary if we are to grasp anything of the essence of the Sun Song, the song of Francis standing before the mysterious gift of the universe, responding with reverence to the inherent value of being.

It must be evident how all nature became for Francis a *scala ad Deum,* for in the being of all things he saw God's creative touch. More, poet that he was, Francis was also aware of symbols. He constantly saw the "wood" of the Cross, the "Lamb" of God, the "Living Water," and the "Flower of the Field," all of them simply added motives for his reverential response. Nature could never become a distraction to him. He would not shut himself up anchorite-wise in a small cell, but rather went out and sang his own part in the *carmen creaturarum,* the part of Francis the man, created, fallen, but redeemed.

Nature in its turn responded to Francis. Birds listened to his preaching, a cricket sang at his bidding, even Brother Fire did not burn him. Without intending to rule out the supernatural in Francis' dealings with nature, we can still see in them something of the pattern of reverence begetting a further response—perhaps even of God's fastening His own stamp of approval on Francis' approach.

d. *Toward Men*

Because Francis' vision of reality was an ordered one, his response to men by far exceeded his response to nature, for in them he discerned a far greater value. Francis paid reverence not only to men with more than the usual marks of holiness, nor only to those with special abilities, nor only to those with superior social standing. His reverence was based rather on a principle, one which Frank Sheed sums up well:

> It is not enough to value strong men for being strong, brilliant men for being brilliant, good men for being good. We must value all men for being

> men, *all* men, weak, stupid, vicious, not only the mediocre average even, but the dismal worst. And we cannot do that unless our view of what man is makes him a thing of value.[24]

Francis' view, of course, saw man as endowed with a rational and immortal soul; by nature, therefore, set above the rest of material creation. Adding to that natural dignity, and enhancing it immeasurably, he knew, is the fact of the Incarnation and Redemption. But more, there was Francis' own concept of the human body patterned after that of Christ.

> Mark, O man, the degree of excellence in which the Lord has placed you, for He has created and formed your body according to the image of His beloved Son, and your spirit after His likeness.[25]

Acting upon such a principle Francis could embrace the leper, deal amicably with brethren so different as Leo, Juniper, Sylvester, Rufino and Elias, and kiss the hand of a fallen priest. Francis was aware that, as Fr. Vann puts it:

> The human being may seem uninteresting or repulsive . . . but in addition there is here a greater mystery, for beneath the externals there may lie hidden a grandeur that is more than human—and if there is not, there is a void the very tragedy of which should compel our love.[26]

That same spirit of reverence impregnated the legislation and admonitions which Francis left as norms for his Order. Superiors are reminded that they are but ministers and servants of the other brothers, that they must admonish their brothers humbly and correct them charitably. The ministers are to receive their subjects charitably and kindly and show such great familiarity with them that the subjects may speak and act with them as masters with their servants.[27] A certain minister was bidden to show kindliness to a fallen brother and "if he does not ask for kindliness, you ask him if he does not wish for kindliness."[28]

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[24] Frank J. Sheed, *Society and Sanity* (N. Y.: Sheed and Ward, 1953), p. 38.
[25] *Admonitiones,* no. 5. *Opuscula S. P. Francisci Assisiensis* (Quaracchi: Ex Typ. Colleg. S. Bon., 1941), p. 8.
[26] Gerald Vann, O.P., *op. cit.,* p. 17.
[27] *Regula II,* cap. X. *Opuscula S.P.F.,* pp. 71–72.
[28] *Epistola ad quendam Ministrum. Opuscula S.P.F.,* p. 109.

The effectiveness of Francis' spirit of reverence is proved by his influence upon his contemporaries and upon the world ever since. Francis was indeed a man of vision and, because of that vision, a real man of power.

e. *Toward Goods of Fortune*

To see Francis' ideal of poverty as rooted in the spirit of reverence is not as far-fetched as it might first appear. Francis indeed chose to be poor because he wished to follow the poor Christ. But can we not say that both Christ and Francis were poor for the same reason, namely, out of respect for the nature of things in themselves as well as to counteract a prevalent abuse of things by would-be masters or men of power?

Goods of fortune, possessions of any type, are good in so far as they are beings. More, by their very nature, but always *according to* their nature, they are meant to serve men. Viewed and used properly, they can help lead man to God; viewed and used improperly, and such an abuse always implies violence and irreverence on the part of the user, they will draw him away from God. It is another example, similar to that of the hedge-carpenter driving the wood to obey him against the grain, of violating the law of the order of things: reverence begets response.

Francis chose poverty precisely because he appreciated things as good, and his early life had given him occasion enough to know the dangers of their abuse. Fr. Guardini observes significantly:

> . . . would Francis have been able to "marry" Lady Poverty with so much radiant enthusiasm and graciousness if he had come from a very poor house? I doubt it. His sacrifice possessed such a high degree of emancipating power because he knew the value of the things he renounced. He knew how beautiful the world is, how delightful abundance, with all its possibilities of enjoyment and munificence.

Fr. Guardini goes on to remark that the general consciousness of the true order of Christian property "is the fertile field from which, when it pleases God, the flower of renunciation climbs into bloom." [29] Poverty and moderation, therefore, vital landmarks in

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[29] Romano Guardini, *The Lord* (Chicago: Henry Regnery Co., 1954), pp. 285–86.

the whole pattern of Franciscan ideals, rest upon the foundation of Francis' spirit of reverence for things.

f. *Other Applications*

Many more examples of reverence at work in Francis' ideals easily suggest themselves. Surely his love of chastity was grounded in his respect for the human body fashioned in the image of Christ. His outstanding obedience to the Church, with its essential hierarchical structure and consequent superior-subject relationship, might well be seen as an expression of reverence. Even his acceptance of the flow of events, often unforeseen, such as the stream of new brethren to his way of life, the demand for a set Rule of life and its ultimate revision, showed his reverence toward the mysterious workings of Divine Providence. Particularly was this evident in his last days as he saw his Order slipping from his ideals and himself powerless to remedy the situation. Handing the reins of leadership to Brother Peter of Catani, he prayed:

> Lord, I commend to Thee Thy family which hitherto Thou hast committed to me; and now on account of the infirmities which Thou knowest, O most sweet Lord, being unable to have the care of it, I commend it to its Ministers, who shall be held in the day of judgment to show cause before Thee, O Lord, if any brother should perish through their negligence, or evil example or bitter correction.[30]

In fact, one might possibly construct an interpretation of the whole life of Francis as well as outline a synthesis of Franciscan spirituality (with quite evident applications to the spirit of the vows, zeal in the apostolate, and so on) by using reverence as the central and unifying concept. Because of the theme of this conference, I wish merely to suggest one further application, namely, the implications reverence can have in even a modern approach to the study of the sciences.

Reverence and the Sciences

Any Christian approach to the sciences will necessarily include respect for God's role in creation. Further, it will always take into

[30] *The Mirror of Perfection,* Sect. IV, ch. 39. *The Little Flowers of St. Francis, The Mirror of Perfection, The Life of St. Francis* (N. Y.: E. P. Dutton and Co., 1951), pp. 283–84.

account God's providence in conserving and governing His creation. Therefore, it must exclude positing any contradictions with what we know to be certain revelation.

A truly Franciscan approach, since Franciscanism is radical Christianity, will go the full way and be radical in its insistence upon reverence for the nature of God, of men and of things. Because of such insistence, a Franciscan approach can produce better scientists and a sounder science. For scientists in their theories and experiments will not force their findings into preconceived molds and rest complacent with apparent answers. Rather they will be aware of the meaning of things as well as of purposes; they will be willing to work with the spirit of *discretio* and watch in wonder as things mature and unfold. Because they are true men of vision with pure aims, they will win a response from nature itself. To quote Fr. Vann again:

> Descartes thought that the supreme purpose of knowledge was to make us masters of nature; there have been more modern advertisements proclaiming knowledge as a paying investment. That way true wisdom will escape us. We might learn from the great scientists themselves—for it is not they, it is their ignorant camp-followers who are utilitarians. We might learn from the great philosophers, who know that wisdom is a mistress who must be wooed in silence and humility. We might learn from the saints, who worship the Truth. Knowledge is power, yes; but before we can use the power with safety we must worship. So with things, and still more with persons. First you must look for them as things in themselves, first you must see and love; then you can use them with impunity and without violence because you will be using them with love.[31]

A scientist imbued with reverence will proceed in the attitude of leisure; he will leaven his rush of study and experiment with the spirit of silence. As a result,

> . . . we shall be able to return to the lilies and find our eyes fully opened. We shall have something much more than an aesthetic sense. We shall see their beauty indeed, and shall rejoice; but we shall see what lies beyond and yet within them, and then we shall know our kinship with the sun and the stars. We shall know, too, our kinship with the halt and the lame, the dull and the stupid, the leper. Then, finally, we shall be whole.[32]

[31] Gerald Vann, O.P., *op. cit.*, p. 22.

[32] *Ibid.*, p. 23. Regarding the importance of a correct attitude in producing sound scholarship we might call attention here to an article by Dietrich Von

We might add that if (and it is a big "if") modern Franciscans in the field of science copy their father in his spirit of reverence, and insist upon it in their students, their approach can become a healthy leaven in scientific study instead of degenerating into a "leveler" as all mediocre approaches must always be.

DISCUSSION

JUNIPER CUMMINGS, O.F.M.CONV.:—Father Leander has given us "not a cold, mental grasp of Francis and his movement," and I'm sure we are enjoying a warm feeling and appreciation.

The analysis of St. Francis as based on reverence is something that we can all take home with us and apply to our lives and work. No doubt our Franciscan scientist will be inspired to appreciate the value of being as such.

Actually such a reverential approach to things and activities is that of the true contemplative. And Franciscans are to be 100% true contemplatives. Our contemplation is to be so full that it overflows into activity. Our activity is not to be a departure from contemplation but a fulfillment of contemplation.

If we would apply the concept of reverence to the center of our science, sacred and profound we would find that St. Francis in his reverence is at the fountainhead of the Franciscan concept of the primacy of Christ. If we look upon Christ not in a practical, utilitarian and perhaps selfish way: if we look upon Christ in Himself as the image of God, the perfection of creation, we arrive at the absolute primacy of Christ. The Humanity of Christ, even abstracting from the useful and necessary (from our point of view), redemption is good, wonderful, excellent in itself. The being of the God-Man is such in itself that of all creation it renders the most glory to God and is therefore first and foremost loved and intended by the Trinity. Thus we see the meaning of Christ.

I am grateful to Fr. Leander for this new light in my field of Christology and I trust that all or many of you have some comment to make as it applies to your particular interest.

I would like to ask Father Leander for the source of his statement that St. Francis says the body of man is created after the image of Christ's body. That is certainly an excellent text for the primacy of Christ. There is also the point of translation of the Canticle of the Sun. Many translations use "for" not "through" for "per" but I looked it up this morning and "per" can certainly be translated as "through."

Hildebrand, "The Idea of a Catholic University," *Journal of Arts and Letters* IV (Spring, 1952), pp. 15–35, and also to the essays "Catholicism and Unprejudiced Knowledge" and "The Role of Reverence in Education" by the same author in his book, *The New Tower of Babel* (N. Y.: P. J. Kenedy and Sons, 1953), pp. 129–79.

JUDGMENTS ON MODERN PHILOSOPHIES OF SCIENCE

Kenneth Dougherty, S.A.

Introduction

The subject of this thirty-sixth annual meeting of the Franciscan Educational Conference is Nature: the Mirror of God. It is fitting, therefore, that in this paper entitled: *Judgments on Modern Philosophies of Science* that judgments be limited to the intension of the central theme of this convention.

Christian philosophy in general (and Franciscan philosophy in particular) views nature as the exemplary of the Divine Exemplar. The truth, the goodness, the beauty of the things of nature is contemplated in the light of the Divine Truth, the Divine Goodness, the Divine beauty. The platonic background of Franciscan Scholasticism enabled its doctors to be especially equipped to turn their speculative minds toward nature, as mirroring the divine perfections in the various grades of created perfection.

As sons of St. Francis the Franciscan Scholastics, medieval and modern, are endowed with an especially gifted insight into nature as a family of brothers and sisters, which reflect, though imperfectly, the perfections of the Creator. St. Francis loved to speak of our fellow creatures of the animal kingdom, the plant kingdom and the inorganic world as his brothers and sisters under the fatherhood of God. All nature was viewed by him as united in love because God is Love. The Greek concept of the heavens and the earth as "a cosmos," a thing of order and beauty reaches its summit in the Christian synthesis and this is marvelously captured by the seraphic mind of St. Francis.

In modern times, Christian philosophers and particularly Franciscan philosophers continue to view nature in this context as the exemplary of the Divine Exemplar. However, there are many philosophers who have departed from this approach. This is evidenced in certain Renaissance philosophies which are pantheistic or

at least tend toward pantheism in which man is glorified as the crown of the universe. We witness these theories in the teachings of the Italian naturalists, Cardano, Telesio, Bruno and Campanello. These men belong to the age of Galileo. They reflect a certain pattern of reaction to scientific discoveries which occurs again and again in modern thought.

In a more profound and lasting sense Cartesian dualism, Humean empiricism and Kantian formal idealism have contributed toward the neglect of nature as the mirror of God, and encouraged the concentration on nature as the mirror of man. Descartes and the Cartesians are outstanding in dividing the material and the spiritual orders into two hermetically sealed spheres. Eighteenth century English empiricism, especially evidenced in David Hume, gave up the notion of causality and much of modern thought began to view nature simply as factual events in temporal sequence. Immanuel Kant and German rationalism considered causality as an apriorism imposed by the mind. Nature is thus understood as simply phenomena reported by the sciences, a study in appearances which does not reveal the being of things. It only reflects the categorical beings of the mind imposed on phenomena.

In many contemporary philosophies of science we witness a departure from the traditional Christian philosophy. Here in contemporary America this is evidenced in the philosophies of science of Albert Einstein at Princeton, Philip Frank at Harvard, in the lectures of visiting professors such as Bertrand Russell, Werner Heisenberg, among others. Some of these men, such as Philip Frank, are easily identified philosophically; Frank is by admission a logical positivist. Others such as Einstein are not so easy to identify, because they are experts in other fields besides philosophy (which I use here in the broad sense) and they more or less philosophize, because they realize basic problems involved in their specialized field of thought.

Man: The Mirror of Nature.

Cornelius Benjamin in an article entitled: "Philosophy of the Sciences" in *A History of Philosophical Systems* by Virgilius Ferm writes:

> Philosophers have always been interested in the sciences as they have been concerned with the major phases of man's activity, and they have felt a certain responsibility to investigate its nature and presuppositions for the same reason that they have considered it their task to examine art, religion, and morality.[1]

The Anti-metaphysical Mirror

It is interesting to note that Benjamin's approach is from the standpoint of what constitutes the major phases of man's activity. Ever since Descartes, so-called "modern philosophy" has begun with man but it has not adequately understood him and reached the reality in which man has his being. The anti-metaphysical attitude especially current here in America prevents the understanding of being, especially in the poverty of the contemporary systems in respect to a doctrine, abstraction, the meaning of causality and its kinds, substance and accident, the categories in general. This is the first characteristic of non-scholastic philosophies of science—their anti-metaphysical character.

It is essentially because of the metaphysical bias inherent in non-scholastic philosophies of science that we do not find a discussion of the metaphysics of exemplary causality—nature: the mirror of God. Occasional negations of finality and consequently of exemplarity are to be found in the systems but only in passing. This of course is not the same as saying that they do not have metaphysical problems. The epistemological problems which are in essence metaphysical, namely, the investigation of the nature of science, its presuppositions and so forth, are legitimate philosophical problems.

In fact it may well be said that these non-scholastic thinkers are very often more keenly aware of the problems besetting a philosophy of science than are some of our Scholastics. I refer to such problems as the unity of science, the definition of basic notions in the empirical sciences such as data, theory, measurement, experimentation and so forth. The philosophy of science is concerned with these concepts in their intension and extension, their inter-relation with the methods of the sciences, and so forth.

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[1] V. Ferm, *A History of Philosophical Systems* (N. Y.: The Philosophical Library, 1950), p. 540.

It is not my task in this paper to address myself to these problems. Our concern here is with the attitude of non-scholastic philosophies of science to nature: the mirror of God. However, these problems are related to our theme. In the first renaissance of the sciences in the Middle Ages nature was understood as the mirror of God because the medieval scientist possessed a *philosophia perennis* rooted in the wisdom of the ancients, especially Plato and Aristotle, which was enriched by Christian thought. The experimentalists of that age were men drilled in logic and philosophy: they could think in terms of wisdom and not merely observe and calculate in terms of a dialectic of probabilities. It is not so in a vast area of modern thought. We are faced today with specialists, equipped in their own fields of research but lacking the common understanding which is the natural gift of philosophy to the educated. The specialists today are endowed with philosophies of science which are the creations of their specialized sciences rather than founded upon being, reality itself. In this way nature has become the mirror of man: what man happens to be thinking about nature at a given time in the history of science, and from the platform, so to speak, of some specialized science.

The Subjectivist Mirror

The second characteristic of modern non-scholastic philosophies of science is its subjectivistic characteristic. It must be understood that a philosophy of science is not the same as a philosophy of nature, however, a philosophy of science must be concerned with nature, the world around us and of which we are a part. Nature, however, is approached by the philosopher of science inasmuch as it is studied by the sciences. The sciences which occupy the attention of the non-scholastic philosopher of science are listed by Benjamin as rational and empirical.[2] The rational are such sciences as mathematics, rational mechanics and so forth. The empirical are physics, chemistry, biology, psychology, sociology and so forth. This division is presented by Benjamin as "commonly accepted." There are no definitions given of course. One much cultivate the habit of not

[2] *Ibid.*, p. 542.

looking for definitions or at least being satisfied with the fact that "a scientific authority" has said what is said.

The non-scholastic philosopher of science views nature as reported by the empirical sciences, especially the new physics. It must be noted that the techniques and terms of these sciences are in the lower levels of the first degree of abstraction; they are often partly real and partly subjective, such as the concepts of space and time. They are, so to speak, partly invented and partly discovered. One must proceed here with the care of the scientists in the laboratory in distinguishing between what is constructed and what is, between the artificial and the natural.

It is in this area of the subjective and the objective that the non-scholastic philosopher of science becomes confused somewhat as John Stuart Mill, the empiricist, was confused as he beheld the ideal grandeur of mathematics. Without a metaphysics, particularly the metaphysics of the analogy of being, without a doctrine of abstraction and the apparatus of the degrees of abstraction to distinguish the sciences, he falls prey to the escapism of the Kantian device of apriorism. As Gavin Ardley in his well documented book on *Aquinas and Kant* has pointed out, the non-scholastic philosopher of science generally treats the theories of modern physics as "subjective, a priori, artificial, conventional." [3] Nature is thus viewed as the mirror of man, the mind of the scientist. It is a kind of formal idealism.

Eddington has made many keen observations on the nature of physical theories. In a chapter on "Selective Subjectivism" in his work entitled: *The Philosophy of Physical Science* the distinguished British scientist exhibits the difficulty of probing the depths of his subject without benefit of metaphysics. The awful curse of British empiricism is evidenced in these pages. He writes:

> The reintroduction of a priori physical knowledge is justified by the discovery that the universe which physical science describes is partly subjective. . . . "Objective" is essentially a negative characteristic (non-subjective) of knowledge, although we regard it as a positive characteristic of the thing to which the knowledge refers; and it is always more difficult to demonstrate a negative than a positive conclusion. I accept an

[3] G. Ardley, *Aquinas and Kant* (London: Longmans, Green and Co., 1950), p. 30 ff.

> objective element in physical knowledge on I think, reasonably strong grounds, but not with the same assurance as the subjective element which is easily demonstrable.[4]

What a departure in English thought from the pre-reformation, Oxonian view of the intellect, the faculty of being. How nature is blurred in the concept of nature: the mirror of man. The Scholastic of course would expect a somewhat blurred image when viewing forms that are in matter, especially through the method of induction, which usually ends in dialectic or probability. However, he understands this in the context of his philosophy of science or that part of the Aristotelian *Analytics,* which subordinates such dialectical knowledge to the demonstrable knowledge achieved in metaphysics.

Metaphysics of course is no substitute for the new physics, in this respect or any other. What we are saying here is that the Scholastic would agree with a great deal of what Eddington is saying about the description of physical science; but unlike Eddington he has a philosophy of being to interpret the description.

The Relativist Mirror

A third characteristic of non-scholastic philosophies of science is their relativistic character. Historically it can be said that the non-scholastic philosophers have been more up-to-date than the Scholastics. They have been more open to new discoveries. This is a human element that must be correctly understood. It was most evident in the seventeenth century when so many Scholastics held to their philosophy of nature, as if it could supply for the rising "positive sciences." I say that it was a human element in the Scholastic philosophers, because it is not an attribute of Scholasticism itself that it should inherently strive to be a substitute for the positive sciences in their respective fields of inquiry.

On the other hand, the non-scholastic philosophies of science have not only been readily open to modern discoveries but they have been more or less absorbed by them. Descartes constructed a mechanistic philosophy out of his mechanics. In time this was

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[4] A. Eddington, *The Philosophy of Physical Science* (N. Y.: Macmillan Co., 1939), pp. 26, 27.

followed by Kant, who sought to supply his own table of categories for the traditional Aristotelian categories and these were made to fit the universe of Newton. In the age of the evolutionary fad in England, Herbert Spencer conceived a philosophy at a time when the biological evolution of Darwin and Huxley (of happy memory) was believed to have a precise scientific meaning. Spencer's philosophy now remains as the arbitrary interpretation of "a law" that no modern biologist would repeat in respectable scientific company.

Marxist philosophy which was initially conceived in the nineteenth century is repeatedly embarrassed by the old fashioned "science" upon which it is based. For many years Einsteinian physics was opposed in the Soviet Union, because it did not conform to nineteenth century dialectical materialism. The same has also been true in the field of biology, particularly in genetics.

The Soviets, however, are especially gifted as a police state in conforming the sciences with their philosophy of science. Whereas other philosophies of science have risen with scientific theories, dominated the scene intellectually for a period and then passed away, "the diamat" or dialectical materialism remains in the countries behind the Iron Curtain. In this case, nature must be the mirror of the men in the Kremlin, whether nature is that way or not. It would certainly merit special study to investigate how scientists such as Fuchs, Pontecorvo and others were duped into believing that the Soviet Union is a paradise for science.

There is a difference between the philosophy of science and "a philosophy" derived from some positive science or sciences. Nonscholastic philosophies of science, as we have shown, take their form and direction from the scientific theories of their age. As such they are relativistic and must be studied and understood in the light of the scientific theories of their period. A contemporary example is the philosophies of indeterminism, which accompany the new physics of Bohr, Heisenberg and de Broglie. The uncertainty principle of Heisenberg, which is of high value in observing the electron according to man's present knowledge, is taken by some to mean that electrons are themselves indeterminate, because man cannot determine the position and velocity of the electron together. The universe for these men of science is only known in terms of probabilities. It is a free universe—free from absolutes. The assumption

here of course is that the uncertainty of one's knowledge means that nature itself is an uncertain thing, which is an easy step to take, if one believes that nature is the mirror of man.

The Mirror of the Frustrated Man

The anti-metaphysical, subjectivist and relativist characteristics of non-scholastic philosophies of science follow a pattern, which is proper to such philosophies in the history of human thought. They frustrate man and leave him with a pessimism, a philosophy of gloom. Nature, the mirror of God, is conjoined with an optimist philosophy by no mere accident of circumstances. Its contrary, nature, the mirror of man, is not conjoined with a pessimist philosophy by way of a casual acquaintance.

Nineteenth century philosophers of science promised man a brave, new world. They lyricized about progress, the scientific spirit, the liberation of the human spirit from the superstitions of the past to the discovery of a better world through the common understanding of science. No one can doubt the fact that the positive sciences have opened up new and wonderful opportunities for human progress in exploring the secrets of the microcosmic and macrocosmic worlds. Technology has taken many of the discoveries of the positive sciences and helped man toward a more comfortable and healthy existence. No one would really want to return to medieval medicine or dentistry or urban living in general, in place of what our age can offer in its technical advancement. But has man, as man, progressed in proportion to the advancement of the positive sciences and technics? The answer is definitely no.

The frustration experienced by Medieval man at the invention of the deadly cross-bow is very small indeed when compared to the frustration of so many modern men as they contemplate the atomic bomb, the hydrogen bomb and other more efficient weapons of destruction. The basic problem is the problem of control, of finality, the moral problem, which is ontologically unintelligible to the anti-metaphysical would-be-philosophers of science. Their subjectivistic and relativistic values can offer no true objective solution but only subjective appeasements, which must change from day to day. The view of nature, the mirror of man, has engendered a picture of nature rebelling, so to speak, and of man frustrated in his own pride.

Einstein—A Modern Example

How very well all of this was illustrated in Einstein particularly in his last years. In answer to the question: whether there is anything in which one can believe: Einstein replied to the editors of a national magazine:

> I believe in the brotherhood of man and the uniqueness of the individual. But if you ask me to prove what I believe, I can't. You know them to be true but you could spend a whole lifetime without being able to prove them. The mind can proceed only so far upon what it knows and can prove. There comes a point when the mind takes a leap—call it intuition or what you will—and comes out upon a higher plane of knowledge, but can never prove how it got there. All great discoveries have involved such a leap.[5]

"Does experience give us truth?" asked the young man.

> Einstein warmed to the boy's search for guideposts. "This is a difficult question," he said, a slight lisp noticeable in his voice. "One is always seeing things without being sure that he does see them. Truth is a verbal concept, which cannot be submitted to mathematical proof." [6]

In this dialogue the anti-metaphysical, the subjectivist, the relativist is evident. The problem of truth is unanswered for Einstein and he takes refuge in a form of intuitionism. He would escape the frustration of uncertainty by a leap into "intuition." Such escapism is the death of philosophy, it is no real solution to the problem. This is the man who would call Scholastics "unscientific."

Writing in *The World As I See It* Einstein remarks about God conceived in man's image, which he would attribute to Scholastics in no small measure:

> The religious geniuses of all ages have been distinguished by this kind of religious feeling, which knows no dogma and no God conceived in man's image; so that there can be no Church whose central teachings are based on it. Hence it is precisely among the heretics of every age that we find men who were filled with the highest kind of religious feeling and were in many cases regarded by their contemporaries as Atheists, sometimes also as saints. Looked at in this light, men like Democritus, Francis of Assisi, and Spinoza are closely akin to one another.[7]

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[5] *Life*, Vol. 38, No. 18, May 2, 1955, p. 64.

[6] *Ibid.*

[7] A. Einstein, *The World As I See It* (N. Y.: *Philosophical Library*, 1949), pp. 26, 27.

To this the Franciscan might well remark: "How positively frustrating, that a man so learned in one discipline, can be so utterly unobjective and confused in the most important discipline of religious thinking." And yet there is here a special challenge to the Franciscan in contemporary American life. Einstein is dead, but there are many who live, who continue this trend of thought. The challenge to the Franciscan is not only to rescue St. Francis from the unhappy company that some experts have given him but also to defend the basic truths whereby men live; in particular, nature, the mirror of the one, personal, true God.

The Franciscan apostolate has always been characterized by a seraphic spirit of charity, gentleness, understanding. In this difficult apostolate toward the non-scholastic philosophers of science these qualities are of high merit. St. Francis has been called "everybody's saint." We have witnessed this in the case of Einstein, who, although he misunderstands the sanctity of St. Francis, he includes him among the great men whom he admired. There is some common ground here. Little can be accomplished by intellectual snobbery toward non-scholastic philosophers of science. A great deal can be accomplished by a charitable attitude of interest toward them and their problems in the epistemology of the sciences and their search for certainty *ex tenebris ad lucem*. This is a special task for the Franciscan philosopher and scientist, or those expert in their fields of inquiry in science beside the science of philosophy.

A final warning must be taken in this critique. The Scholastic must be careful to point out that in his evaluation of any philosopher of science, he is evaluating the expert precisely as a philosopher. He is not passing judgment on his work as a scientist. Thus, whereas we condemn the relativism of Einstein, we are not condemning his theory of relativity. So, too, we are not defending the outmoded aspects of Aristotelian science such as the Aristotelian mechanics but we are propounding the *philosophia perennis* as it is found in the Stagirite.

Our end is truth, Divine truth, in which all created truth participates. We close with the inspiring words of St. Bonaventure in the *Reductio*—"Hic est fructus omnium scientiarum, ut in omnibus glorificetur Deus."

THE TECHNOLOGICAL SPIRIT OF OUR AGE

Berard Tomasetti, O.F.M.Cap.

Modern applications of scientific discoveries to everyday life have transformed our way of life. Modern machines, applying the principles of mechanical advantage to the forces of nature, have placed into the hands of man the control of untold power and natural wealth. The new means of travel, communication and production have converted unpopulated regions of the globe into boom-towns and mighty industrial regions, and vast desert lands into rich, fertile farms.

Few people have been untouched by this revolution. More than two-thirds of mankind are associated in some way with the technical effort which characterizes our civilization. Even the great oriental countries, which for centuries had remained as closed worlds, have been drawn into the net of our new technical culture.

As this technical effort gains more and more momentum, we ask ourselves the question: Where is it leading to? It is the purpose of this paper to discuss the question of whether or not technology is leading us to God.

Definition

By technology we understand the technical achievement, the know-how, which translates into reality the innumerable possibilities opened up by the findings of pure science. Technology is applied science—science applied to human living. It is synonymous with technics, which Lewis Mumford defines as: "that part of human activity which, by an energetic organization of the process of work, man controls and directs the forces of nature, for his own purpose." [1] Cardinal Rufini describes it as: "the meeting of the rational creature with the Creator, who uses the human spirit to continue His work and to impress upon it its final form." [2]

[1] Mumford, Lewis, *Art and Technics* (Columbia University Press).

[2] Rufini, Ernest Cardinal, "Technical Progress and Christian Morality Ac-

Technology is a human activity inspired and carried on by the causality of God. Thus conceived, it is a definite good *per se.* It comes from God, and ought to lead to God. In his Christmas Eve radio address of 1953, His Holiness Pope Pius XII affirmed this: "It is undeniable that technical progress comes from God, and so it can and ought to lead to God." [3]

The direction taken by technology, towards God or away from God, depends upon the spirit of man animating its progress. To answer the question: "Which way is technology leading us?" we must try to discern the prevailing human spirit which directs its progress. This is what we term the technological spirit of our age.

In speaking of the technological spirit of our age, we do not mean to imply that technology possesses a spirit of its own and that it provides its own moral dynamic. Technology, itself, does not possess a moral dynamic; its dynamics is of an entirely different nature, since it deals only with physical power. As a human activity, the moral dynamic is supplied by man's religious spirit. As Christopher Dawson says: "Science provides, not a moral dynamic, but an intellectual technique. It is entirely indifferent to moral considerations, and lends itself with sublime impartiality to any power which knows how to use it—like the Slave of the Ring in the *Arabian Knights,* who is equally ready 'to build a town or to ruin a city, or to slay a king or to dig a river or anything else of the kind.' " [4]

Trend of Technology

Modern science owes its birth to the union of the creative genius of the Renaissance with the mathematical abstractions of Platonic philosophy. In time, the quest for technical progress became associated with man's growing disregard for the human soul and faith in eternal realities. In the last two centuries technology came to be associated with the "Religion of Progress," a religion based upon

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cording to the Teaching of the Sovereign Pontiff," *American Ecclesiastical Review,* V. 131 (1954), p. 149.

[3] Pius XII, "Il popolo, che abitava," *Acta Apostolicae Sedis,* V. 46 (January 16, 1954), p. 2.

[4] Dawson, Christopher, *Progress and Religion* (N. Y., Sheed and Ward, 1938), p. 239.

the denial of the supernatural and consequent belief in the utopia of man's natural perfectibility. It is technology allied to the "Religion of Progress" which has created the technological spirit of our age.

Pope Pius XII describes this spirit as: "the excessive, and sometimes exclusive esteem for what is called 'progress in technology.' This dream was first cherished as the omnipotent myth and dispenser of happiness, then pushed forward by every device to the most daring of conquests; and it has finally imposed itself on the minds of men as the final end of man and of life, substituting itself therefore for every kind of religious and spiritual ideal." [5]

The conquests of technology have tended to give man a sense of self-sufficiency, and the vast possibilities that technological progress paints for him draw him up to a stature which he cannot safely assume. "In consequence," the Holy Father says, "it (technology) is allowed an inadmissible autonomy which, in turn, is translated into a false conception of life and of the world, known as the 'technological spirit.' " [6] It is "nothing else than a particular form of materialism as far as it offers a mathematical formula and utilitarian calculations as the ultimate answer to the question of existence." [7]

Another occupational hazard in technical activity is the very method which is employed—the method of isolation and specialization—the method which has proved so effective and fruitful in bringing about technical progress.

The method of isolation and limitation is sometimes applied to the totality of man's life. He is insulated from the total world of reality by restricting himself to the area of physical reality, and as a consequence he lives in an air-conditioned universe. In this state, man "remains uncomprehending, uninterested, and hence unseeing in the presence of those works of God, the mysteries of Christian Faith, totally different from technology." [8]

Science is the expression of man's passion for breaking down nature into parts, his passion for analysis of function. This bent of

[5] Pius XII, *op. cit.*, p. 6.
[6] Pius XII, *ibid.*, p. 8.
[7] Pius XII, *ibid.*, p. 12.
[8] Pius XII, *ibid.*, p. 9.

mind, unless counterbalanced by an equal passion for integration and unification of his knowledge and intelligence into a purposeful synthesis, disposes man to alter the fabric of his life and restrict the range of his ideals. In this state of mind, man no longer possesses a conception of reality capable of uniting his activity into a purposeful harmony satisfying the whole man; he is incapable of rising to the Creator, who is the harmony and end of all things. "As a result of the whole mechanical process, we cease to live in the multidimensional world of reality, the world that brings into play every aspect of the human personality. . . ." [9]

Effect on Man

Under the influence of the technological spirit of our age men have accomplished great feats, they have built giant bridges, harnessed the power of mighty waterfalls and of tiny atoms, they have reduced long distances to relatively short ones by almost lightning means of travel, but in spite of all these great accomplishments they failed to sound the depth of their own souls. The dense atmosphere of material reality became their natural habitat, and the more rarefied atmosphere of spiritual reality became a region completely unknown and alien to them. They became the victim of an intense activity outside the soul, an activity pursued in the name of progress, a progress which has proved to be chiefly not to, but from the soul, not to, but from God.

Technology, as we have said, *per se,* can and should lead to God; but the technological spirit of our age—technology allied to the rationalistic spirit—leads men away from God.

The God-ward movement is not governed by technology itself, but by the spirit of man who imparts to it its moral and spiritual dynamism. It remains for us now to outline the road built by the union of technology with the dynamic of our Christian Faith.

Prism of Faith

If we take the light of technological developments and pass them through the prism of faith, we can obtain a spectrum of truths

[9] Mumford, Lewis, *Art and Technics* (Columbia University Press).

revealing evidence of God. Technology can and ought to lead to God. A man with the insight of religious faith should be able to follow the road built by the industry and genius of technical know-how and arrive at the feet of God.

The man of faith finds it easy to discover in the works of technological progress evidence of God's solicitude for man. He sees the technologist as an instrument of God's Providence, providing for the needs and welfare of man. This is how St. Francis would look upon the labor of our designers and builders if he were here today. To St. Francis, a man's labor was "the most direct exhibition in creaturely fashion of God's increasing labour for the welfare of His creatures: and as such, labour was sacred to him." [10]

This is something more than the humanitarian point of view which prevails today. The humanitarian motivation is indeed laudable, and is, in fact, a product of the influence of Christian culture. The technicians of other civilizations lacked this humanitarian point of view. The builders of the pyramids of Egypt, and the great wonders of Babylon, Assyria and Rome were completely without regard for the value of human life and labor. Today our builders build with the greatest economy of labor and lives. But there is still a vast difference between this purely humanitarian point of view and the point of view of the man with supernatural faith. One sees the providential character of his work, and the other does not.

Not all men look upon their possessions, gifts of nature and of grace, as a trust which they control for the good of the family of God. Not all look upon the labor which they contribute for the welfare of their fellow men as the fulfillment of the Divine solicitude for men and an expression of God's providence, but those who do are the sons of God and the builders of roadways to God. These enlightened men recognize that technical progress must necessarily rest upon religious foundations, and that the new technical culture cannot be severed from the God who has made it possible and directed its progress.

This reverent attitude of mind towards the products of man's creative genius is a part of our Christian training. The Church

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[10] Cuthbert, *The Romanticism of St. Francis* (N.Y., Longmans, Green and Co., 1915), p. 15.

teaches us this especially in the prayers which she has composed for our use in blessing machines, bridges, airplanes, railways, seismographs, etc. These prayers generally contain a brief acknowledgement of God's provision of all things for the use of man, and conclude with a petition for assistance of man on the way of salvation. The following blessing of a railway is typical:

> Let us pray: Almighty eternal God, who hast set up all elements for Thy greater glory and for the use of man, grant, we beseech Thee, to bless this railroad and its instruments; that while they hasten thy servants on the road, they may walk in Thy law, and running in the way of Thy Commandments, they may deserve to arrive happily at the heavenly land. Through Christ our lord. Amen.[11]

Men of faith draw closer to God as they draw closer to the hidden powers of nature. The engineer, as he gains greater mastery over the powers of nature by the use of his God-given intelligence, finds occasion to humble himself not before the machine which he has created, but before the Almighty who has created him. He sees in himself a reflection of attributes of his Father in Heaven. His search for and discovery of the forces of nature "is at once a search for and discovery of the greatness, of the wisdom, and of the harmony of God." [12]

Finally, through the prism of faith man rejoices in the conquests of technical progress as the fulfillment of a Divine mandate. The leveling of mountains and the spanning of bays, the harnessing of waterfalls and the applications of atomic power, are but fulfillments of the command of God to man to "fill the earth and subdue it." [13] The man of faith can look upon the products of his technical skill and offer them to God as an obedient servant, knowing that he has fulfilled the command given to man at the dawn of creation. Pope Pius XII, in speaking of this temporary heritage given to man along with the divine command adds: "What a long and hard road from then to the present day, when men can at least say that they have in some measure fulfilled the divine command." [14]

We have considered, thus far, how technology can lead man away

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[11] *Rituale Romanum* (Benziger Brothers, N. Y., 1947), p. 407.
[12] Pius XII, *op. cit.*, p. 8.
[13] *Genesis* 1/28.
[14] Pius XII, *ibid.*, p. 7.

from God or to God, and how its declination from God has been rather marked in the past. It remains for us to consider its future course. In what direction will it lead us in the future age?

Future of Technology

We are on the threshold of a new age—there seems to be no doubt about it—a new age of technology. There is reason to hope that a distinctly Christian technology will develop in a similar fashion as did Christian art in the past. It was after the destruction of the Eastern Empire that Christian ideas became, in some ways, reconciled with external, sensible beauty. This union gave birth to a literature and art which was superior to that of ancient times. Can we not hope that out of the present crisis of Western civilization a union of technology with historic Christian tradition will bring about a new, Christian technology?

The need for such a union is apparent to many of our builders of the future. They realize that the vast potentialities for transforming human existence cannot be safely exploited without the directing force of a sound moral purpose—not possessed by technology itself. They realize that: "The return to historic Christian tradition would restore to our civilization the moral force that it requires in order to dominate external circumstances and to avoid the dangers that are inherent in the present situation." [15]

The increase of scientific knowledge and technical know-how has not decreased man's need for religion as the interpreter and guide for human progress, as the rationalists have tried to maintain; on the contrary, the necessity of religious interpretation of life is felt more strongly now than ever before. "The very increase of scientific knowledge, however, only increased the need for moral discipline. To encourage a mature technique for controlling the external world and enlarging all of man's physical powers, whilst permitting man himself to remain at an infantile level was to place dynamite in the hands of children." [16]

It is not unreasonable to hope that as man solves difficulties cre-

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[15] Dawson, Christopher, *Progress and Religion,* p. 258.

[16] Mumford, Lewis, *The Condition of Man* (N. Y., Harcourt, Brace and Company, 1944), p. 244.

ated by his progress in technology—for example, perfecting methods of eliminating air pollution caused by the coming of big industry—so the difficulty created by a technology estranged from historic Christian tradition will be resolved by a happy union.

Spiritualization of Human Nature

The function of the Christian religion is the progressive spiritualization of human nature. This is analogous and complementary to the progressive conquest of the material world, which is the function of technology. The future of humanity depends upon the harmonization and co-ordination of these two functions. Peaceful co-existence will not be sufficient; an enlightened union is necessary.

This union will be brought about by technical men who are conscious of their abiding link with eternal reality. The future depends upon the technologist with a religious formation which will safeguard his mind from onesided influences and inspire him to creative works equal in glory to the works of Christian artists. In the coming age, his contributions may inaugurate a new culture hitherto undreamed of.

May we join ourselves with men of hope who are contributing to the coming of this new era of spirituality, and assert with Cardinal Rufini our confidence "that out of the hard experience of mechanized society there will arise a new spirituality. Ours is the task of accelerating its coming." [17]

[17] Rufini, Ernest Cardinal, *op. cit.*, p. 153.

THE AGE OF THE WORLD

Quintin P. Roohr, O.F.M.Conv.

Man's knowledge of nature is ever advancing in proportion to his ability to devise and use instruments and to understand what they tell him. Nor are these instruments always complex. One of the greatest in existence at the present time consists of a piece of aluminum a small fraction of a centimeter thick and five meters wide and shaped as though it had been cut from the inner surface of a great sphere. Another extremely important instrument is made of a glass tube coated with a conducting material and a fine wire mounted coaxially within it. The first is the giant Hale telescope at Mt. Palomar, and the second is the favorite tool of modern day prospectors, the Geiger-Mueller Counter.

With this great reflector we can see nebulae that are 1.6×10^9 light years distant. There are some 100 million of these extra-galactic nebulae visible. Our galaxy contains some 30 billion stars. Among these there is a yellow dwarf star around which a mediocre planet gravitates. This planet is earth. And although it is an insignificant speck in the small part of creation we are able to see, we are very much interested in it. We live here. Now while there are many aspects under which we could consider our world, all that we are going to attempt is to estimate how old it is.

In figuring out how old the earth is, will we be able to date creation itself? Not by these natural means.

In order to do this, we need the following assumptions:

1. the earth condensed from a filament of a primordial gaseous envelope and fine dust;
2. the primitive earth liquefied partly through loss of heat by radiation and partly by adiabatic expansion (this latter leads to formation of liquid drops which collect towards the center);
3. the formation of the liquid earth with an atmosphere of more volatile constituents probably took a matter of centuries;

4. further cooling brought about solidification which perhaps took a few thousand more years;
5. more time passed until the temperature fell to a point where it was almost entirely maintained by the sun's radiation. This process required a relatively short time.
6. The sun apparently keeps it at this general temperature.

Early Attempts

As soon as the outer crust became cool enough, the steam which, with other gases, surrounded the earth, began to condense and formed the oceans, the rivers and other bodies of water. Due to the action of the sun, great quantities of water evaporate, fall back to the earth in the form of rain and snow and continue a cycle which began with that first condensation.

With this picture, the first estimates for the age of the world were formed. First, if it is known, or can be estimated, how much debris is carried away by the rivers and streams and deposited into the ocean each year, and what the total deposit is, simple division will suggest an age. Secondly, in the early periods of their existence the oceans were sweet, and have only become salty due to the large amounts of salt that is dissolved by the rivers and carried to them. Again, all that we need do is to divide the total quantity of salt now dissolved in the oceans with what is carried into them annually, and we have another estimate of the age of the oceans which is about the same as the first, namely, 300 million years.[1]

Unfortunately, the problem is not that simple and many factors vitiate both these estimates. The present rate of erosion is most likely in excess of former times, due to the many new mountain ranges and also the debris left by the different glacial periods. Moreover some of the salt carried into the ocean may have been removed by subsequent elevations of submerged lands. But these estimates do give us an order of magnitude.

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[1] The total volume of ocean water is about 1.5 billion cubic kilometers, and the concentration of salt is 3 percent. This comes to 40 million billion tons of salt. Geologists estimate that the rivers carry about 400 million tons of salt each year into the ocean. If this erosion had always proceeded at the present rate, the ocean would be 100 million years old.

Also among the early attempts to calculate the age of the world were two notable contributions by Kelvin. First, on the supposition that the sun's energy is maintained by gravitational contraction, he calculated the total energy liberated by the sun in contracting from an infinite distention to its present size at the present rate of supplying this energy. This took twenty million years. Secondly, considering the cooling of the crust, from the time it first began solidifying, Kelvin supposed this cooling was due to conduction, and calculated how the rate of increase of temperature with depth depended on the time that the earth has been cooling. This increase of temperature with depth is known by observation and this method, together with modern data, gives a figure of 27 million years.

While the value of Kelvin's attempts have not disappeared, discoveries since his time show that the earth is much older. The sun, for example, draws on some source of energy much more provident than contraction under gravity, and its rate of energy liberation has been going on for billions of years. Arguments from the earth's thermal state must be modified, too, since the discovery of, and later knowledge of the mechanics of radioactivity.

Having briefly considered some early attempts to solve the problem of the age of the world, let us concern ourselves with the twentieth century, and some of the work that has been done recently and is still going on. At present we can consider three methods for estimating dates for past events. (Again, these are estimates back to some important universe-wide event of total proportion, e.g., the beginning of the stellar recessions.)

1. Consequences of stellar interaction in our own galaxy;
2. Consequences of radioactive decay in terrestrial (or meteoric) matter;
3. Consequences of nebular recession.

Stellar Interactions in Our Own Galaxy

In our own galaxy, the study of stellar motion permits us to put an upper limit on a possible age. It can be shown that under mutual gravitational attraction, a collection of stars moving within a limited space must sooner or later attain a definite distribution of velocities. This is analogous to a Maxwell distribution of velocities

of the molecules of a confined gas.[2] Statistical calculations applied to the stars making up our galaxy indicate that the Maxwell distribution of velocities should be reached in about 10 billion years. According to astronomical evidence, such a distribution has not yet been reached by a large margin. Therefore our stellar universe is less than 10 billion years old.

In regard to studies of these stellar interactions in our own galaxy, several sources of information are present, namely, the dynamics of loose galactic clusters, the dynamics of dense stars and the statistics of wide binaries. Bok[3] considers these studies as strong evidence of his final figure for the age of the galaxy, 3 to 5 billion years. According to Tolman,[4] this is a sensible figure as an estimate of past time during which gravitational interaction has been taking place among stars having roughly the present large scale distribution.

Radioactivity

Since it is our own earth with which we are concerned, what about the rocks of which the crust of our own planet is formed? Can their age be estimated?

The phenomenon of radioactivity, discovered only in 1898, but going on since the forming of the elements, provides a clock by which we can estimate the age of the solid crust of the earth. This radioactivity applies only to some elements like Uranium and Thorium, and among the lighter elements, Rubidium. These elements have the peculiar property of being unstable, slowly disin-

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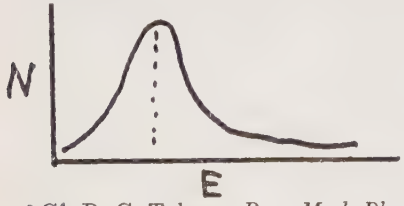
[2] According to Maxwell, the particles of a confined gas at a given temperature do not all have the same identical velocity. (Naturally, due to collisions, etc., some may even be momentarily at rest.) Their velocities can be shown to be distributed according to this curve:



Relative number of particles with different energies at a given temperature. N = number of particles, E = energy.

[3] Cf. R. C. Tolman, *Rev. Mod. Phys.*, 21 (July, 1949), 374–8.

[4] *Ibid.*

tegrating and emitting their constituent parts. These splinters, ejected with extremely high velocities are called alpha-particles and beta-particles. Sometimes a very high frequency radiation called gamma rays take place at the same time. The alpha-particles are actually Helium nuclei (the atomic cores of the ordinary Helium atom), whereas the beta-particles are nuclear electrons.

When an atom of one element emits an alpha-particle, it is transformed into an atom of another element since its atomic mass is decreased by 4 units and its atomic number is decreased by 2 units. For example, consider radium whose atomic mass is 226 and atomic number 88. An atom of radium emits an alpha-particle, and now has an atomic mass of 222 with an atomic number of 86. This is the element we know as the inert gas radon. If only a beta-particle is emitted, the atomic mass remains the same (or to be exact goes down by 1/1800 of 1 atomic mass unit) but the atomic number increases by 1 unit, e.g., rubidium (A = 87, Z = 37) emits a beta-particle and becomes Strontium (A = 87, Z = 38).

Almost all of the naturally radioactive elements lie in the range of atomic numbers Z = 81 to Z = 92, and these are grouped into three series: Uranium - radium series begins with uranium (A = 238, Z = 92), goes through a series of transformations involving alpha-particle and beta-particle emissions finally becoming an isotope of lead (A = 206, Z = 82).[5] Thorium series begins with thorium (A = 232, X = 90) and also becomes lead (A = 208, Z = 82). Likewise, Actinium (A = 235, Z = 92) to lead (A = 207, Z = 82). Note that this series, though called the actinium series, actually starts with the isotope of uranium, U - 235.

We need to know one more thing before using this information for estimating time and that is, how long do these decays take? If we could follow the weight of a sample of an element of very great life, like uranium, from the dawn of history to the present time we could not note the slightest decrease. By means of counting methods,

[5] The following shows how Uranium transforms to lead: 92 U^{238} alpha—90 Th^{234} beta—91 Pa^{234} beta—92 U^{234} alpha—90 Th^{230} alpha—88 Ra^{226} alpha—86 Rn^{222} alpha—84 Po^{218} alpha—82 Pb^{214} beta—83 Bi^{214} beta—84 Po^{214} alpha—82 Pb^{210} beta—83 Bi^{210} beta—84 Po^{210} alpha—82 Pb^{206} (stable). The half lives continually decrease with the parent being the longest (in this case the half-life of the Uranium is 4.6 billion years) and, therefore, all the members of a family found in natural ores are in radioactive equilibrium with the parent element.

the half-life (time it takes for the element to decay to 1/2 its original amount) is used.[6] The rate of radioactive decay remains amazingly constant with time and independent of pressure and temperature as well as the chemical constitution of its surroundings. Thus radioactive substances represent the most dependable type of instrument in the world.

To determine the age of any given sample, then, we need to measure the amount of radiogenic substances that have accumulated. In so doing, however, it must be borne in mind that while the earth was in a gaseous and a molten state, the products of disintegration must have been continuously removed from the place of their origin by diffusion and convection. As soon as the material becomes solid, however, the decay products would accumulate alongside the radioactive elements. We presume, then, that we can get exact information about the time which has elapsed since the solidification took place.

This method has been applied to many samples of lead including the following:

1.765 billion years for a sample of uraninite found in Karelia, Russia.

1.985 billion years for a sample of uraninite found in Manitoba, Canada.

1.460 billion years for a sample of uraninite found in the Black Hills, North Dakota.

Nier[7] made determinations based on data obtained by accurate mass spectographic analysis of constitution of lead and its isotopes found in the common lead ores. He based his calculations on the observed relative abundances of Pb^{206}, Pb^{207}, Pb^{208} and the non-radiogenic Pb^{204}, and got a rough estimate of 5 billion years.

Collins, Russell and Farquhar[8] using samples from 17 different places around the world got for the figure of maximum time since

[6] To determine the half-life, a counting method is used. Take Uranium I which emits alpha-particles. 1 gram emits 12000 alpha-particles per second. The number of atoms in a gram of this element is 2.55×10^{21}. Therefore, the chance for an individual atom to "die" in one second is 12000 divided by $2.55 \times 10^{21} = 4.71 \times 10^{-18}$ per second. This is a constant and gives a half-life of 4.6 billion years.

[7] Nier, J. *Amer. Chem. Soc.* (1938) and *Phys. Rev.* (1941).

[8] Collins, Russell and Farquhar, *Can. J. of Phys.*, 31 (1953), 402 ff.

the formation of the elements: 5.5 billion years, and since the formation of the earth's crust: 3.5 billion years.

One big point of criticism, however, is that in spite of the fact that the earth's crust is presumed solid for the parent element and the radiogenic lead to coexist, some could have escaped during an intermediate step when it existed as a radioactive gas. To overcome this difficulty, some of the radioactive elements whose atomic number is less than 81, and which degenerate to a non-radioactive state in only one step have been examined.[9] One of the best results obtained to date have been done somewhere in Europe on rubidium ($A = 87$, $Z = 39$) which decays to strontium ($A = 87$, $Z = 40$) with the emission of a beta-particle.[10] Of great importance here, however, is the fact that the transformation is made with beta-rays which are weak enough so as not to modify the original crystalline network. This study leads to a figure of 5 billion years since the solidification of the earth's crust.

Nebular Recession

Again we make a transition back to astronomy on some very recent studies. The distances to the nebulae was a mere matter of conjecture until telescopes large enough to reveal individual stars in the so called spiral nebulae were used. As early as 1917, pictures of novae were discovered in spirals. These new stars seemed very dim, whereas the novae known in our own system were exceedingly bright in absolute magnitude. This was the first evidence of the great distances to nebulae.

Another point: it was long known that the luminosity of a cepheid variable depends on its period. Up to 1953, astronomers thought that all cepheids with the same period had the same luminosity. Now two types are known which give two different period-luminosity curves. Type I is four times brighter than type II of the same period. With the use of cepheids as distance indicators, new discoveries of far reaching importance were made. For example the

[9] Chackett, *Phys. Rev.*, 81 (1951), 1057. In which he considered Potassium ($A = 40$, $Z = 10$) which decays to Argon ($A = 40$, $Z = 18$) by beta-particle capture and calculated a value for the age of the atmosphere of 3.1 to 3.5 billion years.

[10] Cf. P. Berthier, *Lumiere et Vie*, 17 (Sept., 1954), 585–596.

Andromeda nebula was calculated in 1929 to be 900 thousand light years distant from us by the use of cepheids. A correction was made in 1944 due to the discovery of obscuring dust in our own galaxy, which reduced the figure to 750 thousand light years. This value was generally accepted until 1953. Then changed again; this time it was doubled. (Photographs taken by the Hale telescope at Mt. Palomar were ¼ as bright as they should have been, which was the first indication of the distance being twice as far as previously thought.) The accepted distance is now considered to be 1.5 million light years. Of course, not only was the distance to Andromeda doubled, the size of the whole visible universe outside of our galaxy had to be doubled.[11] There are, too, other methods of determining distances in the Universe.

Another quantity which is closely correlated with distance to the extra-galactic nebulae is the radial velocity that these nebulae possess. In fact, the universe is expanding at a prodigious rate, if we assume this to be the significance of the red shift seen in their spectra. (Red shift—this states the fact that all the lines in the spectra of these nebulae are removed from their normal positions and shifted towards the red end, i.e., towards the longer wave lengths.) It is to be noted here that the theory of the expanding universe is not solely supported by the red shift, but is also indicated by classical Newtonian mechanics. Because of gravitational forces between galaxies, they cannot be expected to remain static, no more than a tennis ball will remain suspended in mid-air. The system must either contract (under the forces of gravitational attraction, or expand as a result of some dispersing force which is overcoming the attraction. The red shift indicates that the galaxies are fleeing each other with a kinetic energy 50 times greater than the potential energy of the gravitational attraction between them.

A most remarkable thing becomes apparent at this point, and that is, the more remote the object, the greater the shift which means the farther away it is, the faster it is moving. If we may interpret the red shift as a true Doppler Effect due to motion, then nearly all the extra-galactic nebulae of which it has been possible to photograph spectra, are moving at high rates of speed away from

[11] Skilling and Richardson, *A Brief Text in Astronomy*, pp. 276 ff.

earth. Nebulae whose distances can be measured are receding at a rate of more than 100 miles a second for each one million light years distance.[12] This continues as far as spectra can be taken. Note, however, that these are apparent velocities of recession. All astronomers are not agreed. Maybe this red shift will be explained later on by some new principle of physics in an entirely different way. (It is to be noted here, that this idea of all the nebulae seemingly receding from earth does not put us back in the old Ptolemaic idea of the earth as the center of the universe.) [13] Taking the speed of recession as being directly proportional to the distance, then there must have been some time in the past when all matter was compressed together into one huge mass of nuclear density at a fantastically high temperature.

On this basis, Hubble calculated a quarter of a century ago, that the Universe was 1.8 billion years old. This was in serious disagreement with the estimates of geologists and physicists who calculated from radio-active decay that samples on earth are older, and the astrophysicists who made calculations based on the rate of "burning" of nuclear fuel by the stars.

This discrepancy was eliminated in 1953 when Walter Baade at Mt. Palomar discovered the now famous mistake, from new observations on the distances of the extra-galactic nebulae, and therefore the age of the Universe calculated on the basis of the red shift must be multiplied by a factor of 2.8.

Thus, the best figure science can offer at this time puts the age of the universe at 5 billion years.

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[12] For example, Virgo is about 12 million light years from us and seems to be receding at 750 miles per second. Hydra, the most recent to be photographed seems to be traveling at 38,000 miles per second, and is about 700 million light years distant from us.

[13] Take, for example, a growing watermelon; as it grows the seeds inside get farther and farther apart from each other. It makes no difference which one, if any, is stationary. Such would be the case with an expanding universe, and the speed of recession would be directly proportional to the distance.

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DISCUSSION

SIMEON CAPIZZI, O.F.M.:—In regard to the paper delivered by Fr. Quintin Roohr, I have three comments to make:

1. From the title given to his paper, we can see that he has covered the scope of the topic assigned to him.

2. He has gone beyond that limited scope to try to give us an appreciation and an understanding of all that is involved in the problem of estimating the age of the world.

He certainly has given us an appreciation of that problem, but to give us a true understanding of it would require on our part a more extensive knowledge than that which I believe we have.

3. He could have given more force to his paper, if he had in some way tied it into the theme of the conference: "Nature—the Mirror of God." It may not be such an easy thing to do, but perhaps there may be some suggestions from the floor. Are there any comments?

THE MYSTERY OF THE ATOM

Alan B. Wolter, O.F.M.

"Perhaps the most central problem in theoretical physics during the last twenty years has been the search for a description of the elementary particles and of their interactions." [1] These words of the late Enrico Fermi are even more true today than when he uttered them five years ago as he opened his Silliman Memorial lectures at Yale University. Not only have nuclear physicists failed to come up with a satisfactory theory describing the behavior of the elementary matter particles known to Professor Fermi at the time, but even since his death a year ago new particles have been discovered including the elusive "anti-proton" whose existence he had long predicted.

The majority of the twenty some odd "elementary" particles known today belong to the classes known as mesons and hyperons. I would like to say a few words about these "curious particles" as they have been called. For nothing betrays the mystery and complexity of the heart of the atom more than the bewildering brood of mesons spawned there.

Story of the Meson

We should begin the story of the meson, I suppose, with the discovery of the neutron by Sir James Chadwick in 1932.[2] For it was this that prompted Werner Heisenberg's theory that the nucleus of the atom is constructed of neutrons and protons bound together by exchange forces.[3] This wave-mechanical conception has no counterpart in classical mechanics and deserves a word of explanation. The basic notion of an "exchange force" is illustrated in terms of the hydrogen ion molecule. The latter differs from the ordinary

[1] *Elementary Particles* (New Haven, Yale Univ. Press, 1951), p. 1.
[2] *Proc. Royal Society,* A, *136* (1932), 692.
[3] *Zeit. Physik, 77* (1932), 1.

hydrogen molecule in that it has but one electron to bind two protons together. As a first approximation we might conceive the electron as spending part of its time with one proton and part with the other, the electrical charge being thus exchanged between the two. Now the quantum mechanical wave function required to describe such a state might justifiably be considered a combination of two states of equal energy, one where the first proton possesses the electron, the other where the second has it. Now it so happens that the superposition of one wave function on the other yields a combined wave function which represents a lower state of energy than either of the two component states in isolation. This difference turns out to be the measure of the force binding the two protons together. The same situation obtains wherever a system of particles can be represented by two or more states of similar energy. The actual state of the system turns out to be more stable than any of these individual states considered separately, and the energy difference is equivalent to an attractive force known as an "exchange force."

Now Heisenberg assumed some similar force linked the neutrons and protons in the nucleus. The only seeming difference between the two was the proton's electrical charge. Assume that this charge is bandied back and forth between proton and neutron as the electron in the hydrogen ion molecule is passed back and forth between the nuclei. The proton would become a neutron, the neutron would become a proton. Initial and final states would have the same energy. Their combined wave function then should yield an exchange force comparable in magnitude to the attraction between the two nucleons.

Hardly had Heisenberg's theory been proposed when the Italian physicist E. Majorana modified and improved it.[4] The "Majorana forces" as the exchange attraction is called today, still play an important part in theories of nuclear force.[5] However, the primitive theory of Heisenberg and Majorana needed to be altered considerably, and it was this that led Hideki Yukawa, the Japanese physicist, to come up with the concept of the meson.

[4] *Zeit. Physik, 82* (1933), 137.

[5] Cf. e.g., Blatt and Weisskopf, *Theoretical Nuclear Physics* (New York, John Wiley and Sons, 1952), p. 127ff.

Heisenberg and Majorana originally assumed that the charge transwer involved a positive or negative electron. This, however, did not harmonize with the fact that nuclear forces are extremely short-ranged, being practically inoperative at distances greater than 10^{-13} centimeters. The lighter the exchange particle involved the greater the distance of the exchange interaction. We might use the analogy of two players tossing a ball back and forth. The heavier the ball, the closer they must stand together. Theoretically, it can be shown that the minimum or shortest effective range involving a particle of mass m is equal to h/2Pimc, where h is Planck's quantum theory constant and c the velocity of light. For a particle of the mass of the electron, this distance (called the Compton wavelength) is much too large to explain the neutron-proton forces, for it turns out to be of the order of 10^{-11} instead of 10^{-13} centimeters.

Yukawa approached the problem from the reverse direction. If we take 2.8×10^{-13} centimeters as the effective range of nuclear force, he asked, what would the mass of the exchange particle be? It came out to be about 140 times the mass of the electron.[6] Such a particle would presumably be unstable outside the nucleus and Yukawa, assuming it was the simplest form of an electron (positive or negative) emitter, calculated its mean life to be about 10^{-6} second. This "heavy electron" or meson, as it came to be called, could be considered the quantum of nuclear energy in the same way as the photon is the quantum of electromagnetic energy. According to quantum mechanical conceptions the sharp distinction between the particle and the field of force acting on it is erased. It makes little difference whether we regard subatomic entities such as the electron, neutron, gamma radiation as particle or wave. Both aspects are present and can be treated in terms of matrix mechanics or wave mechanics respectively.

As Heisenberg puts it:

> Field and particles are, so to speak, merely different aspects of the same concept. . . . The most correct way of expressing the situation is: There is a nuclear field, and in stationary states this nuclear field takes on the aspect of a short-range field, continually diminishing in intensity away from its centre, while in non-stationary processes it takes on the aspect of a wave radiation. The latter can be observed either as a wave radiation

[6] *Proc. Phys.-Math. Soc. Japan,* 17 (1935), 48.

or as particles, according to the method of observaiton employed. We shall attempt to explain this by comparison with the more familiar electric field, by describing the force exerted by one electron upon another in two languages—first, in the language of waves and then in the language of particles. We can say, first, that an electron produces an electric field around itself, and that this electric field spreads in conformity with Maxwell's equations. It may act on another electron and create a force on the latter. The corresponding description in terms of the other aspect is: One electron produces a particle, a photon, and this photon is subsequently absorbed by another electron. Thus in the first phrasing we speak of a 'production of a field,' and in the other of a 'production of a particle'; in the first statement, we refer to an 'action of a field', in the second one to an 'absorption of a photon by a particle.' This state of affairs can be expressed schematically as follows:

Wave aspect: Electron creates field; field acts on another electron

Particle aspect: Electron emits photon; photon is absorbed by another electron. Both statements describe the same event. The first version is familiar to everybody who has ever had any dealings with electric fields. The second one is unfamiliar to most people, because in technical science as well as in macroscopic physics it is always unnecessary to conceive of an electric field as linked to photons. Under atomic conditions, however, this very frequently proves to be a useful expedient.[7]

In similar fashion, we can speak of the interaction of proton and neutron in terms of the meson from two viewpoints. Using the wave mechanical language we can say that the neutron creates a meson field, which field acts on the proton, or vice versa, the proton creates the field which acts on the neutron. Using particle language, the same phenomenon could be described thus. The neutron emits a negative meson which meson is absorbed by the proton, or vice versa, the proton emits a positive meson which is absorbed by the neutron.[8]

If the analogy between photon and meson holds, we would expect that mesons would be emitted or absorbed in nuclear reactions which involve nuclear energy levels, just as photons are emitted or absorbed in radiation phenomena which involve the electronic

[7] *Nuclear Physics* (New York, Philosophical Library, 1953), pp. 97–98.

[8] The photon or meson emitted and absorbed in these processes is usually called a "virtual" photon or meson, inasmuch as an actual emission and absorption would violate the laws of conservation of energy and momentum. However, the "virtual" photon could be said to have existence in so far as the Heisenberg uncertainty principle allows the laws of conservation to be violated by an amount delta E provided it is paid back in time delta t where delta E x delta t = h/2 Pi. Cf. e.g., G. Feldman, "Meson theory of Nuclear Forces," *Science News, 35* (1955), 42–54.

energy levels. This would be the case, Yukawa explained, if the meson did not have such a relatively great rest mass. For in most nuclear reactions (those not initiated by high-energy particle bombardment) the energy necessary for the formation of a meson is not usually available. Instead the meson can break up directly or indirectly into electrons and neutrinos by processes involving less energy. This happens, as it were, in the very moment of the meson's formation. As Heisenberg explains it: "First, the Yukawa particle is formed from the nuclear field—or more correctly, the nuclear field itself is identical with the Yukawa particle, which for lack of sufficient energy for its formation cannot manifest itself as a real particle. Instead, no sooner is it formed than it breaks up into electrons and neutrinos, which then actually leave the nucleus." [9]

According to the Yukawa theory, however, we should expect real mesons to be produced in nuclear reactions initiated by high-energy protons such as those that form the major component of primary cosmic rays. Consequently, the discovery of mesons among cosmic ray products by Anderson [10] hardly a year later (1936) seemed at first sight to be a clear confirmation of Yukawa's theory. Like a pack of hunting dogs on a fresh scent, physicists concentrated practically all their efforts in this field to running down this lead. In the decade that followed dozens of variations of the meson theory were elaborated in a vain attempt to bring some correlation between the observed behavior of the cosmic ray meson and that expected of the quantum of nuclear force. While the cosmic ray meson decayed as Yukawa predicted, this was about the extent of its cooperation. For the rest it showed a strange reluctance to associate with nucleons, manifesting no affinity for nuclei as the meson of nuclear force should. Its recalcitrancy, however, only spurred nuclear theoreticians to greater efforts. As it turned out later, they were running down a blind alley for ten years. But this became apparent finally in 1947 when a group of Italian physicists [11] demonstrated

[9] Heisenberg, *Nuclear Physics,* p. 102.

[10] Anderson is usually credited with its discovery although two independent research teams reported the existence of the meson practically simultaneously. C. D. Anderson and S. H. Neddermeyer at the California Institute of Technology [Cf. *Phys. Rev., 51* (1937) 884] and J. C. Street and E. C. Stevenson at Harvard (Cf. *ibid.,* 1005).

[11] M. Conversi, O. Piccioni and E. Pancini in *Phys. Rev., 71* (1947), 209.

conclusively that the cosmic ray meson had even less interaction with nucleons than believed and could certainly not be the quantum of nuclear force. A few months later, however, the meson theory received a new lease on life when Occhialini, Powell and Lattes in Bristol, England discovered Anderson's cosmic ray meson was really the decay product of another meson. They called this primary meson pi, whereas they labelled the cosmic ray or "meson meson" mu.[12] The pi-meson, or pion, behaved quite as Yukawa predicted, interacting strongly with nuclei, being easily scattered and readily absorbed by the latter. The excellent qualitative agreement between the Yukawa particle and the pion won for the Japanese physicist the Nobel prize in physics for 1949.

Since then physicists have been working feverishly for an exact quantitative theory that would describe the coupling between mesons and nucleons. Despite the great progress made[13] a completely satisfactory theory has not been achieved to date.[14] The original exchange force concept of the meson, however, has been greatly expanded. In addition to strict exchange forces which operate only between proton and neutron,[15] other "ordinary" or Wigner forces[16] must be postulated to account for the fact that

[12] G. P. S. Occhialini, C. F. Powell, and C. M. G. Lattes in *Nature, 160* (1947), 453, 486.

[13] Cf. Bethe and de Hoffmann, *Mesons and Fields,* vol. 2 "Mesons" (Evanston, Ill., Row, Peterson and Co., 1955), pp. 186–321.

[14] Cf. H. S. W. Massey, "Survey of Nuclear Forces" and M. M. Levy and R. E. Marshak, "Brief Report on the Present Status of the Meson Theory of Nuclear Forces" in *Proc. of 1954 Glasgow Conference on Nuclear and Meson Physics,* edited by Bellamy and Moorhouse (London, Pergamon Press, 1955), pp. 1–10 and 10–23.

[15] Experimental confirmation of Heisenberg's exchange force theory did not come until later when in 1947 some remarkable observations were reported from the Radiation Laboratory in Berkeley, California. When 100 Mev. neutrons were used to irradiate paraffin, or passed through a Wilson cloud chamber filled with hydrogen gas, the neutrons that passed close to the proton core of the hydrogen atoms were seemingly transformed into protons, whereas the protons they grazed became neutrons. Cf. e.g., S. Glasstone, *Sourcebook on Atomic Energy* (New York, D. Van Nostrand, 1950), p. 338.

[16] Historically the peculiarity of the Wigner force is its short range rather than its lack of exchange character. E. P. Wigner in *Phys. Rev.,* 43 (1933), 252 first suggested that exceedingly short range forces could account for the neutron-proton scattering as well as the large binding energy of He^4 as compared with the deuteron. Later on the term Wigner force was equated with short-range non-exchange forces. Any short ranged force implies that the

nuclear forces act also between proton and proton or between neutron and neutron. This "charge independence" of nuclear force [17] led to the postulation of a neutral meson whose virtual emission and absorption would account for proton-proton or neutron-neutron interaction.[18] Only later when it became possible to produce meson artificially was evidence for the neutral pion discovered.

Physicists today are more or less generally convinced that the pi meson which occurs in positive, negative and neutral forms [19] holds the key to mystery of nuclear force. The problem is to discover the equation or set of equations that will adequately describe its interaction with nucleons. Once this is found, the physicist can proceed to more complex problems involving the interaction between nucleons by means of their pion fields. Though this fundamental problem has not been solved as yet, it has stimulated extensive experimentation with the end result that the properties of both the pion and muon are relatively well known. In the course of experimentation, however, the existence of additional mesons and even of particles somewhat heavier than nucleons were discovered. The latter are now

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quantum of energy involved has a non-zero mass. Consequently, if an interaction, say between a proton and proton, be described in terms of the emission and absorption of a virtual quantum (*viz.*, the neutral meson) as is usually done, this does not mean that the force is not an ordinary or Wigner force but an exchange force. The exchange force applies to those situations where the virtual emission and absorption involves an electrically charged meson (either positive or negative).

[17] The theorem of charge independence (which states that the attraction between proton-proton is of the same magnitude as that between neutron-neutron, provided allowance is made for the Coloumb repulsion due to the like charges on the protons) was first advanced by G. Breit and his collaborators (Cf. *Phys. Rev., 50* (1936), 825, 850; *ibid., 52* (1937), 936) but since has been adequately confirmed.

[18] As early as 1938 Frölich, Heitler and Kemmer recognized that charge independence implied a neutral meson. Cf. *Proc. Roy. Soc.* A, *166* (1938), 154. N. Kemmer then proposed his symmetric meson theory, according to which both positive and negative as well as neutral mesons are presumed to be coupled to the nucleon and the strength of the coupling is the same for all. Cf. *Proc. Cambridge Phil. Soc., 34* (1938), 354.

[19] In nuclear physics the charge state of an elementary particle such as the pion is given the quantum mechanical designation known as *isotopic spin* (sometimes called isobaric spin or simply I-spin). It was originally applied to nucleons (the proton was given a positive one/half I-spin, the neutron a negative one/half I-spin), but was extended to pions, where it has the values +1, −1, and 0 accordingly as the pion is positive, negative or neutral.

called *hyperons,* and the mesons themselves are divided into two generic groups, the light or *L-mesons* (which include the familiar pion and muon) and the heavy or *K-mesons.*[20] Small Greek letters are used to designate the individual species of mesons, whereas capital Greek letters are reserved for the hyperons. We shall indicate briefly the principal characteristics of the mesons and hyperons whose existence is generally recognized at this date.[21]

L-mesons

The light or L-mesons comprise particles with a mass greater than that of the electron and up to, and including that of the pion. Only five types are known to exist, namely the positive, negative and neutral Pi-mesons, and the positive and negative Mu-mesons.

The Mu-meson is the lightest of the mesons and, as we mentioned, was the first to be discovered experimentally. There seems to be only the charged variety, nor are there any plausible theoretical reasons for postulating a neutral Mu. The mass, which can be determined by several methods (e.g., the range and momenta relative to the pion; the study of the electron decay spectrum; or the energies of X rays emitted between two Bohr orbits in a mesic atom), is about 206.9 m_e.[22] The lifetime has been measured with great accuracy and turns out to be 2.22×10^{-6} seconds. The only observed decay product is an electron. However, the latter has a variable energy with a maximum around 55 Mev (million-electron volts). If energy and momentum are to be conserved in the reaction at least two other particles must be emitted, which since they are not observable in

[20] This nomenclature was introduced at the 1953 International Cosmic-Ray Congress held at Bagnères, France. Confer the report of E. Amaldi and others in *Physics Today, 6* No. 12 (Dec., 1953), 24.

[21] We have based listing on the elementary particles accepted by the generality of nuclear physicists at the time of the Fifth Annual Rochester Conference on High Energy Nuclear Physics held during the early part of this year. Cf. the *Proceedings* of the Conference compiled and edited by Noyes, Hafner, Yekutieli and Raz of the Department of Physics, University of Rochester and distributed by Interscience Publishers, New York City. See also the *Proceedings of the 1954 Glasgow Conference on Nuclear and Meson Physics,* esp. Part VIII (pp. 324–352); K. G. McNeill, "International Developments in Nuclear Physics," *Nucleonics, 12,* No. 9 (Sept., 1954), 49; C. Dilworth, G. P. S. Occhialini and L. Scarsi, "Heavy Mesons," *Annual Rev. Nuclear Science,* vol. 4 (1954), p. 271ff.; H. A. Bethe and F. de Hoffmann, *op. cit.*

[22] m_e is the abbreviation for electron masses.

the cloud chamber directly or indirectly are presumably neutrinos. Hence the accepted decay scheme

$$\begin{aligned} Mu^+ &\rightarrow e^+ + 2Nu \\ Mu^- &\rightarrow e^- + 2Nu \end{aligned}$$

The energy released in the process (symbolized by Q) is about 105 Mev. The negative muon does not react strongly with the nucleons and it can be made to replace one of the electrons in the electron shells to form what is known as a "mesic-atom." Mu-mesic atoms serve as a useful tool for exploring the electric field near the nucleus. It was through such a study that the nuclear radius was found to be about 15% smaller than previously believed.

The pi-meson occurs in both charged and neutral varieties. The charge (either positive or negative) is always unitary (that of the proton or electron). This can be inferred from the principle of the conservation of electric charge in the following reactions:

$$\begin{aligned} Pi^+ + d &\rightarrow p + p \\ Pi^- + d &\rightarrow n + n \\ Pi^- + p &\rightarrow n + Pi^o \\ Pi^- + p &\rightarrow n + 2\ Gamma \end{aligned}$$

The mass of the charged variety can be determined by the deflection in a magnetic field and appears to be the same for both positive and negative pions, namely, 273.3 m_e.[23] The mass measurements of the neutral pion are understandably less accurate and are estimated from the energies of the two gamma decay products, or more accurately from the mass difference in the reaction

$$Pi^- + p \rightarrow n + Pi^o$$

Measurements such as these indicate that the neutral pion is between nine and ten electron masses lighter than the charged variety, which is understandable since the latter would be expected to have an increased mass due to their self-energy that results from the interaction of the pion's charge with the electric field.

The mean lifetime of the charged pions is of the order of 10^{-8}

[23] d = deutron, p = proton, n = neutron, and gamma = gamma photons.

seconds which is unusually long compared with most subatomic phenomena. The value given for the positive pion is 2.55×10^{-8}.[24] The negative pion is more difficult to measure since it is readily captured by nuclei if any matter is present, but within the limits of observational error it seems to be the same as that of the positive pion. The neutral variety, however, is very short lived and is difficult to measure with any accuracy. It seems to be about 5×10^{-15} seconds.[25]

The decay scheme of the charged variety is the following:

$$\text{Pi}^+ \rightarrow \text{Mu}^+ + \text{Nu}$$
$$\text{Pi}^- \rightarrow \text{Mu}^- + \text{Nu}$$

Since the energy the muon receives in virtue of the decay is constant (about 4 Mev) yet less than the total energy released in the process (about 33 Mev) one and only one additional particle is required to explain the decay process. Since it is not observable it is presumably a neutrino.

The decay scheme of the neutral pion is this

$$\text{Pi}^\circ \rightarrow 2 \text{ Gamma } (Q = 133 \text{ Mev.})$$

K-mesons

The heavy or K-mesons are those whose masses lie midway between those of the pion and nucleon. Generally it is in the neighborhood of one half the nucleon mass. The new 6 Bev. Bevatron at the Radiation Laboratory of the University of California has been able to produce a great variety of K-mesons. In many instances it is difficult to distinguish one from the other. Usually the individual varieties are denoted by small Greek letters such as the tau and theta mesons, but they may also be designated by the group name with a subscript describing the decay products. Thus Ke indicates a K-meson that decays into an electron, K-mu and K-pi denote heavy mesons which decay into muons and pions respectively. Sometimes an additional number is added to show the total number of decay products. Thus K-pi-2 indicates that this heavy meson has two

[24] M. J. Jakobson, et alii, *Phy. Rev., 81* (1951), 894.
[25] B. M. Anand, *Proc. Roy. Soc.* A, *220* (1953), 183.

decay products one of which at least must be a pion. Without claiming any completeness to the list, nuclear physicists recognize the following types of K-mesons: the tau, the theta, the K-pi-two, the K-mu-two, the K-mu-three, the K-e-three.

The *tau meson* first discovered in 1949 is the most thoroughly studied of all the heavy mesons and hyperons. It occurs in both positive and negative forms, the former naturally appearing in greater abundance since it is not so readily absorbed by positively charged nuclei. The decay products are always coplanar and total zero so that it can be safely inferred that no additional neutral particle is emitted. The mass can be computed directly from the measurement of the length of the primary tracks, but a more accurate method is to estimate it from the masses and kinetic energy of the decay products. This latter method yields the mass of 967 m_e. The decay scheme is the following: [26]

$$T^+ \rightarrow 2\,Pi^+ + Pi^- \qquad (Q = 75\ Mev)$$
$$T^- \rightarrow 2\,Pi^- + Pi^+$$

The lifetime is around 5×10^{-9} seconds. Most tau mesons observed decay at rest rather than in flight. Their production seems to be the direct result of nuclear collisions and not of the decay of heavier particles or hyperons.

Next to the tau, the *neutral theta* seems to be the best established of the heavy mesons. Its mass is $965 \pm 10\ m_e$. It decays as follows: [27]

$$Theta^o \rightarrow Pi^+ + Pi^- \qquad (Q = 214\ Mev.)$$

Its lifetime is about 1.5×10^{-9} seconds.

There is also some recent evidence for a positive theta which decays into a positive and neutral pion.[28]

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[26] If the theorem of charge independence holds an alternative mode of decay into one charged pion and two neutral pions should be possible.

[27] An alternative mode of decay into two neutral pions has been suggested. Further, it has been suggested that certain anomalous events observed could be explained either as a neutral theta decaying into a pion and muon of opposite charges plus a neutrino or as a neutral tau decaying into one neutral pion and two of opposite charges.

[28] A. L. Hodson, et alii, *Phys. Rev., 96* (1954), 1089.

Reasonably certain of the *K-pi-two,* formerly known as the chi meson or charged theta $\pm$. It occurs in both positive and negative form. The decay pattern is this:

$$\text{K-Pi-2}^+ \rightarrow \text{Pi}^+ + \text{Pi}^\circ$$
$$\text{K-Pi-2}^- \rightarrow \text{Pi}^- + \text{Pi}^\circ$$

The decay energy is 212 Mev. which would indicate the mass of the K-pi-two is about 952 m_e.

The *K-mu-two* was discovered only last year at Paris and given its present provisional designation.[29] The proposed decay scheme is

$$\text{K-mu-2}^+ \rightarrow \text{Mu}^+ + \text{Nu}$$

Since the observable secondary does not manifest a strong interaction with nuclei it is considered to be a muon rather than a pion. The neutral particle seems to be a neutrino. There is some uncertainty about the decay energy (235–255 Mev.) and consequently about the mass (920–960 m_e).

The *K-mu-three* (formerly called the kappa meson) is so designated because its presumed decay product is this:

$$\text{K-mu-3} \rightarrow \text{Mu} + 2\ \text{Nu}$$

Because of the variable energy of the observed muon, a three particle rather than a two particle decay is postulated. The mass, estimated from the highest energy muons emitted, seems to be around 1000 or more electron masses. It has been suggested that this meson may represent simply an alternate mode of decay of the *K-pi-two* in which the decay scheme would be

$$\text{K-pi-2} \rightarrow \text{Mu} + \text{Nu} + \text{Pi}^\circ$$

However, too little is known about the meson to draw any conclusions.[30]

The *Ke meson* (K_e3) is so called because the heavy meson has only one electron as its decay product, but the variable energies of

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[29] Gregory, Lagarrique, Leprince-Rinquet, Mueller and Peyrou, *Nuovo Cimento, 11* (1954) 292.

[30] Cf. *Proc. Fifth Annual Rochester Conf.,* p. 128.

the latter argue to a three body decay. Hence the proposed decay scheme:

$$K_e3 \rightarrow e + 2 \text{ neutrals}$$

The latter are presumably neutrinos.

Other K-mesons have been reported,[31] notably one with a mass of about 1400 m_e whose decay products have not been studied, as well as another with a mass around 1200 m_e which decays into a light secondary particle of high momentum.[32]

Hyperons

A Hyperon or Y-particle is an elementary particle with a mass greater than that of the nucleon. The various kinds are designated by capital Greek letters. Because they were responsible for the first V-events [33] they were formerly referred to as V-particles. Like the nucleons, the hyperons are fermions with half-integral spins.[34] They also behave like nucleons in that they seemingly exert nuclear force and are capable of emitting virtual pi mesons strongly coupled to

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[31] Dilworth, Occhialini and Scarsi "Heavy Mesons," *An. Rev. Nucl. Sci.*, v. 4 (1954), pp. 271–311.

[32] *Ibid.*, p. 309.

[33] From the phenomenological viewpoint mesons and hyperons are classified on the basis of their decay as S-events and V-events. The former indicates that the decay occurs only after the meson or hyperon has been stopped (hence the S) in a cloud chamber or photographic emulsion. The V-events are those which can be interpreted as the decay of a K-meson or hyperon in flight. They are subdivided into V^o and $V^{\pm}$ depending on whether the initial or primary particle is neutral or charged. In a neutral V-event (which were those first observed) the two charged secondaries into which the invisible primary particle decays form two visible tracks in the cloud chamber that look like an inverted V. The decay can be shown to be spontaneous and not due to some collision. Where the primary meson or hyperon is charged, its path in the cloud chamber is visible and the V is formed when the initial particle decays into a charged and a neutral secondary, only the former leaving a visible track that angles away from the first track to form a very broad V.

[34] All the heavy mesons (with the exception of Kmu3 and K_e3 if we assume the correctness of the decay schemes given) as well as the pion are bosons, and hence have integral spins; the muons, hyperons, like the nucleons electrons and neutrinos are fermions. The bosons and fermions are so called because of the quantum mechanical statistics used to deal with them. Bosons obey the Bose-Einstein statistics, the fermions the Fermi-Dirac statistics. The latter follow the Pauli exclusion principle and have a half-integral spin; the former do not follow Pauli's principle and have an integral spin.

them in the same way that pions and nucleons are coupled. Before a hyperon may disintegrate, therefore, it may unite momentarily with the nuclei of atoms, the binding energy of the hyperon being of the same general order as that of a nucleons. Because of this similarity of a nucleon and a hyperon, physicists find it convenient to designate the two by the common name *baryon* (i.e. a heavy particle).

First found among cosmic ray phenomena, hyperons can be produced artificially. The pioneer work in this field has been done with the Brookhaven cosmotron. A 1.37 Bev. beam of negative pions was used to bombard a hydrogen filled cloud chamber. The high-energy pions unite with the protons to form neutral lambdas plus a neutral K-meson (presumably a theta).

$$p + Pi^- \rightarrow L^\circ + Theta^\circ$$

In some cases the products of the pion bombardment may be a negative hyperon and a positive K-meson. Hyperons may also be formed when nuclei disintegrate after capturing a negative K-meson. The K-meson unites with a nucleon (proton or neutron) to form a hyperon plus a pion.

The *neutral lambda* is the best investigated of the hyperons. It decays after a lifetime of 3.86×10^{-10} seconds in the following way

$$L^\circ \rightarrow P + Pi^- \qquad (Q = 37 \text{ Mev.})$$

The charge symmetry principle suggests that the decay products could also be the following

$$L^\circ \rightarrow n + Pi^\circ$$

To account for certain anomalies in the decay energy values observed an alternative decay scheme is assumed.

$$L^\circ \rightarrow p + Mu^- + Nu$$

The mass of the lambda is 2180 m_e.

The *sigma* ($S^\pm$) is the charged counterpart of the lambda [35] with

[35] Gell-Mann and Pais postulate a neutral sigma on theoretical grounds which is different from and decays into the neutral lambda (plus a gamma photon). Cf. their article "Theoretical Views on the New Particles" in *Proc. Glasgow Conf.*, pp. 342–352.

an observed mass of 2327 m_e for the positive variety and 2325 m_e for the negative. After a lifetime of somewhat less than 10^{-10} seconds, it decays in either of two ways:

$$S^{\pm} \rightarrow n + Pi^{\pm} \qquad (Q = 110 \text{ Mev.})$$
$$S^{\pm} \rightarrow p + Pi^{o} \qquad (Q = 116 \text{ Mev.})$$

Finally, there is the negative *xi* hyperon known sometimes as the "cascade particle" because it decays only through a two step cascade into a neutral lambda and negative pion

$$Xi^{-} \rightarrow L^{o} + Pi^{-}$$

The decay energy is about 60 Mev. which would bring the mass of the xi to the neighborhood of 2570 m_e. The mean lifetime seems to be of the order of 10^{-10} seconds.

At the present time, nuclear physics is in much the same situation as atomic physics during the first decades of this twentieth century before the unified quantum theory was elaborated. A great deal of factual information about nuclear phenomena and laws has been uncovered, but we still lack an overall theory to integrate them. This lack is particularly apparent when it comes to explaining the interrelation between the various mesons and hyperons. Hardly a beginning has been made. Fermi and Feynman,[36] for instance, have suggested that hyperons might be regarded as virtual compounds of pions and nucleons, but their theory bristles with unsolved problems and we have no way of solving the mathematical equations required to test it. More recently M. Gell-Mann and A. Pais have tried a different and more promising approach, but it is too early to pass any further judgment on their interesting hypothesis.[37]

From all we have said so far, however, this much should be clear. The atom, far from being indivisible as its name implies, betrays a richness and complexity that will provide man with many a problem for years to come. To the man of faith, indeed, it says still more. For it indicates how easy it is for God to intrigue the mind of man with

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[36] An unpublished report. The essence of their theory is presented by Gell-Mann and A. Pais. Cf. the following note.

[37] M. Gell-Mann and A. Pais, "Theoretical Views on the New Particles," *Proc. Glasgow Conf.*, pp. 342–352.

even the simplest and lowliest of His creatures. Everything His creative hands have touched, it seems, carries away a fingerprint of His infinite intelligibility so that even if the tiny atom did nothing more, it would mirror in its own way something of the endless mystery of its Creator.

EXISTENCE OF GOD AND MODERN SCIENCE

KIERAN F. QUINN, O.F.M.Cap.

Introduction

The address of his Holiness, Pope Pius XII, to the Pontifical Academy of Science on November 22, 1951, represented a modern vindication of three of the age-old proofs of St. Thomas Aquinas for the existence of God. His Holiness brilliantly took some of the findings of modern science and showed how they strengthened these proofs and led to a belief in a Creator. The first part of this paper will follow the papal allocution and expand when necessary the treatment of the scientific evidence so as to make it more understandable to the non-scientist. Since the first part considers the scientific facts and where they should lead a fair-minded man, the second part will attempt to show that scientists in every field do find that nature is a mirror of God; that from the wonders of nature, they do conclude to the existence of God—indeed, according to one of the five ways of St. Thomas.

PART I

A Short Summary of the Five Ways

As a preliminary it might be helpful to review briefly the five arguments of St. Thomas for the existence of God. The five ways of St. Thomas start from an observation and study of nature. They are based on experience in the world about us, but from there they proceed to a philosophical plane and the validity of the proof rests on a philosophical principle. They are all based ultimately on the principle of causality. "As regards the terminus of these five proofs, they manifest: 1) the necessity of a first cause, as first mover, first uncaused cause, first necessary being; 2) the perfection of the first cause, as most perfect, most simple, and the ordainer of all things to an end." [1]

[1] Garrigou-Lagrange, Reginald, *The One God,* (B. Herder Book Co., 1943), 137.

First Proof: From Motion

We observe in the world around us things which are in motion. Motion is taken in the broadest sense. First and most evident is local motion: the movement of bodies in space; the movements of particles which make up gases, liquids and solids; and if we may believe the scientist the motion of electrons within the atoms themselves. Besides local motion we understand here substantial, qualitative, or quantitive changes. For example, changing from non-living to living or vice-versa, change of color, growth. "We are also concerned. . . . with the spiritual motion of our intellect and our will." [2] In short, any passage from potentiality to actuality is meant here.

Now sense-perceived motion always presents us with a mover and a thing moved. "Quidquid movetur ab alio movetur." This is true of local motion. A thing cannot be both mover and moved. Physicists express it in the law of inertia: a body at rest will remain so, or a body in motion will remain in motion in a straight line unless acted upon by some outside force. Changes of quality or quantity likewise require a mover and moved. A cell cannot grow of itself but requires many outside agents to help it grow. Stated more exactly the principle would read:

> Anything movable is in the state of potentiality with respect to the movement which it may undergo. When the movement takes place, the potentiality is (being) actualized. Now, it is a principle of metaphysics that nothing is actualized except under the activity of something which is already actual; no potentiality is self-actualizing. St. Thomas Aquinas puts the point thus: "Motion takes place inasmuch as things are changed from the potential to the actual, and this demands some actual agent to move them from the potential state." [3]
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> Therefore, whatever is in motion must be put in motion by another. If that by which it is put in motion be itself put in motion, then this also must need be put in motion by another, and that by another again. But this cannot go on to infinity, because then there would be no first mover, and consequently, no other mover; seeing that subsequent movers move only inasmuch as they are put in motion by the first mover; as the staff moves only because it is put in motion by the hand. Therefore it is necessary to arrive at a first mover, put in motion by no other; and this everyone understands to be God.[4]

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[2] *Ibid.*, 140.

[3] Glenn, Paul J., *Theodicy*, (B. Herder Book Co., 1947), 63.

[4] Aquinas, St. Thomas, *Summa Theologica*, trans. Fathers of the English Dominican Province, Vol. I (Benziger Brothers, 1947), 13. (Pt. 1 Q. 2 Art. 3).

Second Proof: From Efficient Cause

An efficient cause is one that by its own action produces an effect. Every effect has a cause. The world is full of examples of efficient causality. The past, present and future show a connection and can only be explained by efficient causality. Effects exist and they demand efficient causes. Among these efficient causes that we see there is a subordination of one to another. The whole of nature is shot through with the cause and effect relationship, making the natural sciences possible.

Furthermore, a thing cannot be an efficient cause of itself, for it would then exist before itself. What then can account for these chains of efficient causes as we see them in nature? Someone might try to explain the existence of a thing by an infinite series of causes. But if you have no first cause then all causes which come after it would not exist. It could not be a circular series with A producing B, and B producing C, and C producing D, and then D producing A. For A and D would have to be both cause and effect at the same time. A would have to exist and not exist at the same time, for it would have to exist to produce B but it could not exist until produced by D. A circular series of causes thus involves a contradiction.

Therefore since no effect in nature can efficiently cause itself or be caused by a series of natural causes, there must be a First Cause which has no cause, namely, God.

Third Proof: From Contingency

The third way according to Saint Thomas of demonstrating the existence of God is arrived at from the consideration of contingent or "possible" things in the world around us. The word "possible" in the terminology of St. Thomas classifies a being which has within itself the potentiality of generation and corruption. Things are possible to exist or not exist. "We find in nature," he writes, "things that are possible to be or not to be, since they are found to be generated, and to corrupt, and consequently, they are possible to be and not to be. But it is impossible for these always to exist, for that which is possible not to be, at some time is not. Therefore if everything is possible not to be, then at one time there could have been

nothing in existence." [5] The Latin of St. Thomas is even stronger: "Aliquando nihil fuit in rebus." (At one time nothing was in existence.)

St. Thomas always safeguards his proof from the attack of those who would insist on a world existing from eternity, since he admits one cannot disprove, on philosophical grounds, the possibility of such a world. In the third proof he uses the possibility of such an eternal world to strengthen his demonstration. Because on the supposition that the world is eternal, all possibilities would have been actualized and among those possibilities is the corruption of *all* corruptible (possible) beings.

So the existence of "possible" beings presupposes the existence of the being who does not have the possibility of non-existence. St. Thomas goes even further and writes that the existence of beings that are not subject to corruption—secondarily necessary beings like pure intelligences or angels—does not explain the existence of either themselves or "possible" beings, since they do not have the cause of their secondary necessity in themselves but must have it from a Being who is absolutely necessary both as to origin and duration.

Fourth Proof: From the Degrees of Perfection

The fourth way of demonstrating the existence of God is based on formal causality and is arrived at from the consideration of the degrees of perfection in the world around us. And the argument is based on the pure perfections of goodness, truth, and nobility. The more of these perfections you find in anything, the closer that being is to goodness, truth, and nobility itself, which is God.

St. Thomas tries to give an example of such formal causality from the world of sense experience. The example is unfortunate and makes us smile at the naive science of the 13th century. But who knows but that our science of the 20th century will be smiled at long before the 27th century has passed. As St. Thomas and the men of his century understood the world, there were four fundamental elements and one of those was fire. Fire, the very essence of fire, was

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[5] *Ibid.*, 13.

the cause of warmth, no matter where it was found. The hotter a thing was, the more they thought it had of the very essence of fire in it, and the closer it was to the formal cause of all warmth, the element—fire. So, argued the Angelic Doctor, it was with the formal causality of all the perfections. There is metaphysical goodness in a mineral, more of it in a plant, more in an animal, still more in man, and still more in an angel—and step by step we are getting closer to the cause of all goodness, who is Goodness itself, or God.

Fifth Proof: From the Governance of the World

In the fifth way to arrive at the philosophical demonstration of the existence of God, St. Thomas asks us to consider the purposefulness there is in even the non-intelligent creatures. It must be kept in mind that St. Thomas does not argue that there is an over-all plan in the world. With our limited vision we can often not see that. To our minds many creatures are useless, or even malignant in the over-all view we have of the world. But St. Thomas asks us to look simply at the fact that they act for an end. They reach the goal of their being, at least in most cases. That alone demands an intelligence, and such an intelligence as has not as yet appeared among men. All that the greatest scientists have been able to do, at least up to now, is to find out how things work towards their goal. No one has had the consummate conceit to say that he has drawn the plans and put the purposive action into even the least of the elemental atoms.

The conclusion of St. Thomas is easy to draw. "Therefore some intelligent being exists by whom all natural things are directed to their end; and this being we call God." [6]

Much could be said about the contributions that the sciences, especially biology and astronomy, have made to experimental evidence of design in the universe.

But the findings of science which the Holy Father concentrated on in his address to the Pontifical Academy had reference mainly to the first and third proofs, namely, the mutability and contingency of the universe.

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[6] *Ibid.*, 14.

A. The Mutability of the Universe

1. In the macrocosm

As was seen, the first proof for the existence of God is taken from the fact of motion or change in the universe. Everything that moves or changes must be moved or changed by another. Therefore we must eventually arrive at a being who is immovable, immutable, unchangeable.

One of the most impressive facts about nature offered by all the sciences is the mutability of nature, "as though confirming with new proofs the theory of Heraclitus: 'Everything is in flux': panta rhei." [7]

Besides the usual local or mechanical motion that everyone sees or experiences in some way, most everyone is aware of changes taking place in nature. The usual division learned by the student of elementary physics and chemistry is that of physical and chemical change. A physical change taking place in matter does not alter the composition of the matter. Changing ice to water and then to steam are examples of physical changes for the chemical formula H_2O describes the make-up of the substance whether it is in the solid, liquid, or gaseous state. If an electric current is passed through liquid water two gases are formed, oxygen and hydrogen, and this separation of water into two new substances is described as a chemical change.

Chemists have found that all matter can be broken down into some ninety-odd substances called elements, and it is by different combinations of these elements into stable units called molecules that the tremendous variety of materials in the world is formed. This building of molecules from the elements and tearing of molecules down to the elements goes on with furious activity in all of nature. Every cell in the human body is a chemical works wherein materials are brought in, altered chemically, converted from dead to living matter. This activity proceeds at a fast rate while the body is growing and the cells dividing and reproducing themselves. Even after maturity is reached and growth practically ceases, each cell periodically has a complete turnover of the elements which make

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[7] Pius XII, "Modern Science and the Existence of God," *The Catholic Mind,* Vol. 50: no. 1071 (March, 1952), 184.

it up. Animals and plants around us in their cycle of birth, growth and death, are constantly experiencing physical changes from the outside and continuous, complex, chemical changes within themselves.

This alteration of substances through physical and chemical changes is not confined to the earth. The telescope and spectroscope offer evidence that the heavenly bodies are composed of the same elements which make up our earthly substances and indications are that physical and chemical changes take place continually on the heavenly bodies that surround us.

2. In the Microcosm

In 1804, John Dalton formulated the modern atomic theory and said that all matter is made up of tiny indivisible particles called "atoms." These atoms were the building blocks as it were of all material things, and were unchangeable and indestructible. For nearly a hundred years this idea of the immutability and indestructibility of ultimate matter persisted. Then in 1896 Henry Becquerel made the disturbing discovery of radioactivity. This new phenomenon was found to be the spontaneous blowing up of atoms, which were thought to be so indestructible and immutable. It was found that the disintegration followed a regular law and the amount of material that decomposed over a period of time could be predicted. For instance, if one started with a pound of radium only half a pound would be left after 1690 years, a quarter of a pound after another 1690 years and so forth. The rate of decomposition could not be altered by any known external forces, such as pressure, heat, or cold. So the proponents of the immutability of matter sought final refuge in the idea that matter was permanent and indestructible in so far as man could not alter it. But even this last refuge was demolished.

Through much research the following picture of the atom began to emerge. There was an inner core or nucleus which accounted for most of the weight of the atom and had a positive charge. At definite distances in fixed orbits and according to definite laws electrons moved about the nucleus. These electrons were found to be extremely small pieces of matter which had a negative charge. The negative charge of the electrons and the positive charge of the

nucleus counterbalanced one another, so that the over-all charge of an atom was zero. It was a solar system in miniature: the nucleus was the sun and the spinning electrons the planets. Man found it easy to alter the atom by knocking off one or more electrons, but the nucleus, the inner core, was more rugged and seemed capable of resisting all of man's efforts.

In 1919, Rutherford successfully disrupted the nuclei of nitrogen atoms by bombarding nitrogen gas with particles which spontaneously issued from Radium C. Then about 1930, J. D. Cockroft and E. T. S. Walton devised an atom smasher. They were able to accelerate particles to fantastic speeds and allow them to impinge on targets of various materials. Upon analysis of the target they found that some of the original element of the target was changed into an entirely different element. Since that time many new and more powerful machines have been devised so that man can alter at his whim and fancy the nuclei of atoms. He has even increased the number of elements beyond the 92 normally found in nature, through use of new methods and more powerful machines. So man with his atom smasher shattered forever the idea of the immutability of the atoms of this earth.

At the same time as this work in nuclear physics progressed the solution to one of the great problems of astrophysics became clear. It had to do with the production of immense quantities of energy on the billions of stars around us. According to Carl Von Weizsaeker and Hans Bethe the sun and the stars are continuously changing the element hydrogen to the element helium, by taking four hydrogen atoms and fusing them into one atom of helium. In this production of helium vast quantities of energy are released and appear mainly as light and heat. So even in the heavens around us nature is continually altering the elements. It would seem, too, that the sun and the stars act as giant atom-smashing machines, making the efforts of man appear puny in comparison. We are being bombarded constantly by so-called cosmic rays from outer space, which rays appear to be streams of very high-energy particles. They are able to penetrate to great depths into the earth. Every minute hundreds of atoms of our bodies and billions of atoms in things around us are being shattered by these cosmic rays. The origin of these rays is still a mystery, but it would appear that they are being

shot out by our sun and other stars as a result of the nuclear changes going on there in the production of solar and stellar energy.

3. Conclusions About Mutability

There has been established

> beyond all possible doubt the explicit mutability of the inorganic world, large and small: the countless transformations of the forms of energy, especially in the chemical decompositions and combinations taking place in the macrocosm and, in no smaller degree, the mutability of chemical atoms, even down to the sub-atomic particles of their nuclei.
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> Therefore, the scientist of today, directing his gaze more deeply into the heart of nature than his predecessor of a hundred years ago, knows well that inorganic matter is, so to speak, in its innermost being countersigned with the stamp of mutability, and that, consequently, its existence and its subsistence demand a reality entirely different and one which is by its very nature invariable.
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> Just as in a picture done in chiaroscuro (black and white), the figures stand out on a background of darkness, and only in this way achieve the full effect of form and life, so also the image of the eternally immutable Being emerges clear and resplendent from the torrent which snatches up and carries off with itself all the material things of the macrocosm and the microcosm in an intrinsic mutability which knows no pause.[8]

Modern science speaks out with a most powerful voice in confirmation of the words the Angelic Doctor used in the second sentence of his proof from motion: "It is certain and evident to our senses, that in the world some things are in motion." Now it is not only certain and evident that some things are in motion, but nature to the very core is shot through with mutability. Science has so strengthened the experimental evidence of change and motion in nature, that no reasonable man can deny it.

B. Direction of Changes in Nature

The second momentous fact unearthed by modern science which the Holy Father calls attention to and discusses at some length is the direction of the changes which take place in nature. Scientists deal constantly with energy and energy-changes in all forms. As a result of years of experimentation and observation they have found energy-changes to be subject to three laws known as the three laws

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[8] *Ibid.*, 186–187.

of thermodynamics. It has been said that these three laws are the result of human frustrations. "Our failure to invent a perpetual-motion machine has led us to postulate the First Law of Thermodynamics. Our failure ever to observe a spontaneous flow of heat from a cold to a hotter body or to obtain perpetual motion of the second kind has led to the statement of the Second Law. The Third Law of Thermodynamics arises from our failure to attain the absolute zero of temperature." [9]

The first law of thermodynamics deals with the creation and conservation of energy. It states that energy can neither be created nor destroyed, that the total amount of energy in the world remains constant. Because of nuclear reactions where energy appears to be produced at the expense of some of the matter of the atom, this law has been changed to read: the total amount of matter and energy in the universe is a constant. The second law of thermodynamics, the law of entropy, has to do with the degradation of energy. This is the law under discussion for it states the direction in which all energy changes go.

We may distinguish two kinds of energy from the point of utility: useful and useless energy. Useful energy is that which can be used to do work and useless or unavailable energy cannot be harnessed to do work. Mathematically entropy is the ratio of useless to useful energy. Clausius, who discovered the law of entropy, stated the second law thus: "The entropy of the universe tends always toward a maximum." So the amount of useful energy, called by the scientist "free energy," is constantly decreasing. Thus temperature differences tend to level out, a hotter body will give its heat to the surroundings and make everything around it come to the same temperature; water always tends to seek its own level; fuels which are our source of free energy are being exhausted; machines waste free energy by frictional losses. This is also happening on the sun and stars around us. They generate energy and radiate it away into space and it never returns. They will continue to glow less and less, will finally flicker out and be shrouded in everlasting night.

It was thought that natural processes were reversible. In other words, scientists at first thought that nature could rejuvenate her-

[9] Moore, Walter J., *Physical Chemistry* (Prentice-Hall, Inc., 1950), 84.

self. By some mysterious process she could replenish her supplies of energy, return to the vigor of her youth and thus continue forever. But mountains of evidence have piled up to confirm the law of entropy. On the basis of scientific work we can only conclude that the world is running down. Like a huge clock once wound up and the key thrown away, it cannot run forever but must eventually stop. Nature is slowly but surely dissipating her store of useful energy upon which all life and motion depends, and the death of all living things is only a matter of time.

With the advance of nuclear science has come the discovery of new and vast supplies of free energy. Atomic power has made available stores of useful power we had not thought possible. But even here the law of degradation of energy seems to apply. In the production of atomic power some of the material of the atom has to be sacrificed to produce useful energy. If the materials are weighed before and after the reaction it is found that a small amount of matter disappeared in the reaction and appeared as energy. For instance, in the process by which the sun produces its energy, four hydrogen atoms are fused into one helium atom. There is a disappearance of about seven-tenths of one percent of the original mass of the four hydrogens. In all of these productions of atomic energy a minute amount of mass disappears and there is produced a very large quantity of energy. But even here we witness a degradation of energy. Matter which is available as a source of useful energy is being used up and we know of no way to reverse the process.

Now His Holiness draws conclusions from this direction of change in the universe.

> If the scientist turns his attention from the present state of the universe to the future, even the very remote future, he finds himself constrained to recognize, both in the macrocosm and in the microcosm, that the world is growing old. In the course of billions of years, even the apparently inexhaustible quantities of atomic nuclei loose utilizable energy and, so to speak, matter becomes like an extinct and scoriform volcano. And the thought comes spontaneously that if this present cosmos, today so pulsating with rhythm and life, is, as we have seen, insufficient to explain itself, with still less reason will any such explanation be forthcoming from the cosmos over which, in its own way, the shadow of death will have passed.
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> Let us now turn our attention to the past. The farther back we go, the more matter presents itself as always more enriched with free energy, and as a theater of vast cosmic disturbances. Thus everything seems to indicate that the material universe had in finite times a mighty beginning,

provided as it was with an indescribably vast abundance of energy reserves, in virtue of which, at first rapidly and then with increasing slowness, it evolved into its present state.[10]

Since scientific evidence points to a beginning of the universe two questions naturally arise. "Is science in a position to state when this mighty beginning of the cosmos took place? And secondly, what was the initial and primitive state of the universe?" [11]

C. Age of the Universe

In general there are two acceptable methods of measuring the age of the universe, astronomical and radioactive. The astronomical method has two independent ways: the recession of spiral nebulae and the gradual dissolving of the union of star clusters and double stars. The radioactive method, as the name implies, employs measurement of the radioactivity of the earth and meteorites, and calculating from the residual radioactivity and the products of that activity the age of the earth and stars.

1. Recession of Spiral Nebulae

Astronomers have found that the earth is a member of a group of heavenly bodies called the Milky Way. A group of heavenly bodies which stays together and moves as a unit through space is called a galaxy. In our galaxy, the Milky Way, there are suns, stars, planets, moons, meteorites and vast clouds of cosmic gas and dust. Membership runs into the billions of stars and other bodies in one galaxy alone. With present telescopes it is estimated that there are over a trillion galaxies. What numbers will be revealed as telescopes get better no one knows. The late Edwin Hubble of Mount Wilson observatory devoted nearly his whole life to a study of these spiral nebulae or galaxies and found that their motion was not random or haphazard, but they appeared to be going away from our galaxy at a speed proportional to their distance from us. He and his associate, Milton L. Humason, in 1929 published an equation which gave the speed of the receding galaxies: $V_m = 38r$. The velocity in miles per second of any galaxy as it speeds away from us

[10] Pius XII, *op. cit.*, 188.
[11] *Ibid.*, 188.

is 38 times its present distance from us, which distance is measured in millions of light-years. This law is applicable to any galaxy.

Evidence for the fact that these galaxies are speeding away from us, that we live in an expanding universe, is furnished by the spectroscope. When light from a distant galaxy is viewed through a spectroscope, we find the same pattern of bands of light ranging from the red to the violet as that produced by a source of white light on the earth. However, there is this difference. Each band is moved toward the red end of the spectrum and it is a very regular thing. This is known as Doppler's Effect. We have experienced this with sound. As a car approaches from a distance with horn blowing, the pitch of the sound gradually rises to a maximum and then as the car recedes from us we notice the pitch gets lower. Pitch, or highness or lowness of a sound depends on the number of vibrations sent out per second by the sounding body. Because the horn is moving the frequency and therefore the pitch of the sound will be different than if the horn is stationary. The same principle applies to light. The color is determined by the frequency of the light. A body emitting light and moving toward an observer will cause him to see a shift of the spectrum toward the violet end of the spectrum, while a body moving away shows the red shift. Since all galaxies show this red shift, the almost unanimous agreement among men of science is that the universe is constantly expanding.

As a consequence theories have arisen as to how this all came about. Abbe LeMaitre was the first to propose a theory. In the beginning the universe was one huge ball of matter and the galaxies, including our Milky Way, were formed and shot out by one tremendous explosion. Further alterations took place in the galaxies themselves until they evolved to their present state. Be that as it may, astronomers calculate from the speed of recession of the galaxies that the universe is about 5 billion years old.

Astronomers also measure the age of the universe by observing star groups and double stars. In the heavens there are paired stars or double stars. They are usually of different sizes and are therefore subjected to different gravitational pulls by the bodies around them. Gradually the partnership breaks up. A study of these binary systems again fixes the age of the universe at about 5 billion years. Stars are also found in clusters of hundreds or thousands. Dif-

ferences of gravitational pull on the individual members of the cluster will tend to make some escape after a time from the cluster. Calculations based on observations of these star clusters give a figure of from 3 to 5 billion years as the age of the universe.

2. Radioactivity

As was mentioned before, radioactivity is the spontaneous breaking up of certain atoms of the elements. This spontaneous disintegration follows a regular law and is not affected by external forces like light, heat, cold, or pressure. The two heaviest elements in nature, uranium and thorium, are radioactive. When a uranium atom disintegrates, the products are an alpha particle, which becomes an atom of helium gas, and another substance which is radioactive. This substance in turn disintegrates to give another product which is radioactive, the process continuing until with the generation of a fifteenth substance we come to what is called uranium lead. This is stable and no further disintegration takes place. Uranium lead can be distinguished from ordinary lead because it weighs one unit less than ordinary lead. Thorium goes through a like process and the eleventh member of this series is stable and does not disintegrate.

Fortunately the rate of disintegration of uranium is a very slow process. Starting with a pound of uranium 238, it would only be half disintegrated after four and one-half billion years. By analysis of a rock sample containing uranium, uranium lead, and helium, chemists have estimated the age of the earth to be about 5 billion years. This of course has been checked using other radioactive series but the same figure turns up from the calculations.

It is agreed that some meteors come from stars around us. The age of these fragments of the stars has been determined by the same radioactive method and again the same figure for the age of the stars turns out to be about 5 billion years.

We see that from two independent sciences we get answers in agreement to the question: How old is the universe?

D. The Original State of the Universe

If then, as science seems to indicate, all matter was crowded together into one super-atom of matter billions of years ago, what

was the state of that matter? There are various theories but they all agree that the state of matter was entirely different from the state we know today. The density, temperatures, and pressures must have been enormous. Without such conditions it would have been impossible to form the atoms as we know them. This first state of matter must have been one entirely different from what we know. How it reached this state scientists admit that they cannot begin to give an answer. The scientist Dr. George Gamow speculates that all matter was squeezed together into elementary particles of enormous mass and density and heated to billions of degrees. Slowly the mass began to expand and cool and when the temperature fell to about a billion degrees the atoms as we know them were formed. How this primitive matter got in this unnatural state there is no way of telling. Science can go no further.

Conclusions Drawn From the Direction of Change

From this direction of change in nature we can look into the future and see that we may expect an end to the world as we know it. And looking into the past this direction of change points to a beginning. Modern science has "followed the course and the direction of cosmic developments, and, just as it was able to get a glimpse of the term toward which these developments were inexorably leading, so also has it pointed to their beginning in time some five billion years ago. Thus, with that concreteness which is characteristic of physical proofs, it has confirmed the contingency of the universe and also the well-founded deduction as to the epoch when the cosmos came forth from the hands of the Creator." [12]

Another conclusion pointed out by a philosopher-scientist was this: "The chief philosophical significance of the law of entropy consists, not in evidence of a beginning of the universe in time—important as that is—but rather in the evidence that the natural world is not self-explanatory. Energy by the very nature of things loses its power. It cannot be self-sufficient. . . . Nature points beyond itself for an explanation of itself." [13]

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[12] *Ibid.*, 191.

[13] McLaughlin, P. J., *Modern Science and God* (Clonmore and Reynolds Ltd., 1952), 68.

In coming around through its findings to the idea of a creation and an end to the world, modern science has abandoned the old idea that matter is eternal and indestructible. These findings have broadened and strengthened the experimental evidence upon which the third proof from the contingency of the universe rests. Science fixes pretty definitely the time at which the atoms of matter were formed, the time of the beginning of the first life on this world, and in the normal course of events could predict a time when all life would cease.

And since nature itself is not self-explanatory and self-sufficient it needs a being outside itself to explain its existence. Nature points outside itself to the Necessary Being of St. Thomas' third proof.

In summary, we may say that modern science has made available experimental evidence for the first, third, and fifth ways of St. Thomas which no reasonable man can gainsay. By furnishing this powerful support upon which the philosophical arguments rest, modern science has made a very valuable contribution which makes the arguments stronger and more convincing than they were.

Part II

When a Bedouin was asked how he knew there was a God, he replied, "How do I know whether a camel or a man passed my tent last night? By their footprints in the sand." Does the scientist actually see and recognize in nature the footprints, as it were, of God? Does nature as a mirror reflect to them the wisdom, power, and mercy of God? Do the works of nature give a true picture of God to the scientist?

In general we may say that nature does mirror and reflect some idea of God as Creator to the majority of scientists. In a tour of the nation's laboratories reporter Howard Whitman found that the older scientists especially have the deepest sense of the divine. "It is the cocksure youngster in the laboratory, Whitman found, who says, 'How wonderful I am! Look what I've found in the atom!' The old man says, 'Isn't God wonderful—look what He's put in the atom!' " [14]

[14] "Deus ex Laboratorio," *Time,* Vol. 58: no. 7 (August 13, 1951), 64.

When we view ourselves in a good plane mirror the reproduction is faithful and true. But when looking in a concave mirror we may see an image upside down, blurred, or out of proportion. Just as when we look in different types of mirrors we see true or distorted pictures, so, too, the pictures of God received from nature by scientists are sometimes clear and other times blurred and distorted.

George Gallup, the mathematician and pollster, said that he "could prove God statistically. Take the human body alone—the chance that all the functions of the individual just would happen is a statistical monstrosity." [15] Here is an argument for the existence of God from design.

What Scientists Say

A noted anatomist, Dr. David Grant, argued to God along the same lines. While dissecting a human body in front of his class he said:

> Gentlemen, here in this human organism is a complete refutation of what is called atheism. No reasonable being can look upon the miraculous construction and arrangement of organs in this body without acknowledging that some Creative Power above and beyond human comprehension must have been responsible for them.
>
> No one can deny that every creation must have a creator. There must be some Power, First Cause, or whatever you wish to call God, because the mere mechanics of human procreation do not and cannot explain how a man's body comes into existence. It seems to me that doctors, above all others, should be truly religious, dealing constantly as they do with this inexplicable miracle.[16]

Dr. Robert Oppenheimer is said to have remarked after the first atomic explosion: "For the first time the physicist has known sin." Through his work with the atom an engineer at Brookhaven National Laboratory came to know God more intimately, and was sure he could account for God scientifically. "Up in the pile," he said, "we see mass disappearing and becoming energy, but nowhere can we add to or subtract from the total mass and energy. Where did mass and energy come from? . . . We have found laws to prove we

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[15] George Gallup, *Reader's Digest,* Vol. 43, No. 258 (October 1943), 7.

[16] Keating, Orrin, "I Was An Atheist Until," *Reader's Digest,* Vol. 41: no. 247 (November, 1942), 57.

can't make it. Yet it must come from somewhere. There must be a Higher Power who can make it." [17]

As was said, sometimes the mirror of nature gives to the scientist a more detailed and clear picture of the Creator than at other times. Listen as Sir James Jeans, the astronomer, gives us his picture of God.

> To speak in terms of Plato's well-known simile, we are still imprisoned in our cave, with our backs to the light, and can only watch the shadows on the wall. . . . It is not impossible that some of the shadows thrown on the wall of our cave might suggest objects and operations with which we cave dwellers were already familiar in our caves. . . . And when scientists study the world of phenomena, the shadows which nature throws on the wall of our cave, they do not find these shadows totally unintelligible, and neither do they seem to represent unknown and unamiliar objects. . . . A scientific study of the action of the universe has suggested a conclusion which may be summed up, though very crudely and quite inadequately . . . in the statement that the universe appears to have been designed by a pure mathematician. . . .[18]
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> From the intrinsic evidence of his creation, the Great Architect of the universe now begins to appear as a pure mathematician. . . .[19]
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> If the universe is a universe of thought, then its creation must have been an act of thought. Indeed the finiteness of time and space almost compels us, of themselves, to picture the creation as an act of thought; the determination of the constants such as the radius of the universe, the number of the electrons it contained imply thought, whose richness is measured by the immensity of these quantities. . . . Modern, scientific theory compels us to think of the creator as working outside time and space as part of his creation, just as the artist is outside his canvas.[20]

Nature reflects to Jeans a picture of God as a Pure Mathematician, the Great Architect, Thinker of a Creative Thought, a Creator outside the universe. His argument shows a mixture of the arguments of efficient cause and contingency of St. Thomas.

Dr. Warren Weaver gave as one of his reasons for believing in God the argument of universal belief of mankind.

> I accept the idea of God for three reasons: First, in the total history of man, there has been a most impressive amount of general agreement about the existence (if not the details) of "God." This agreement is not so logically precise as the agreements about electrons; but far, far more

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[17] "Deus ex Laboratorio," *Time*, Vol. 58: no. 7 (August 13, 1951), 64.
[18] Jeans, Sir James, *The Mysterious Universe* (McMillan Co., 1930) 135–140.
[19] *Ibid.*, 144.
[20] *Ibid.*, 154.

> people believe and have believed in God than believe or have ever believed in electrons. Second, I know I cannot think through the realm of religious experience as satisfactorily as I can think through certain smaller and less important problems. The nuclear physicist today only has incomplete and contradictory theories. But the theories work pretty well and represent the best knowledge we have on a very important subject. Third, I accept two sets of ideas of God—the everyday concept of an emotional and intuitive God, and the intellectual concept of an abstract God—for the very solid reason that I find both of them personally satisfying. It does not at all worry me that these are two rather different sets of ideas; if an electron can be two wholly inconsistent things, it is a little narrow to expect so much less of God. . . . I think that God has revealed Himself to many at many times and in many places. I think, indeed, that He keeps continuously revealing Himself to man today. Every new discovery of science is a further "revelation" of the order which God has built into His universe.[21]

Here are displayed some rather unusual arguments for the existence of God. The first, the argument from universal belief of mankind, is a common and acceptable one. The second and third arguments make the belief in God acceptable from a standpoint of utility, the third especially since the ideas about God are personally satisfying. The last reason might be taken as an argument from design but in this connection the author is speaking of the Bible and his "revelation" of God through science is put somewhat on a par with the revelation of God contained in Holy Scripture.

Shortly after the theory of evolution became popular some proponents of evolution loudly proclaimed that science had established facts and discovered theories that entirely excluded the need or the intervention of a creator. They took for granted that matter was eternal, always here, and through the medium of chance all the wonderful design and order of the universe evolved. But Christians maintained that matter does not exist of itself; that it was produced by a creator and that the evolution that took place in it is not the effect of blind forces but a consequence of creative action.

Lecomte Du Nouy

The French scientist Lecomte Du Noüy, while holding to the theory of evolution, fired a devastating blast at the idea of chance

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[21] Weaver, Warren, "Can a Scientist Believe in God?" *Look,* Vol. 19: no. 7 (April 5, 1955), 30.

being the instrument of evolution in his book *Human Destiny* in 1947. From his studies in evolution he concluded that "chance" as the instrument is unscientific and false, and that scientific facts give proof of God being absolutely necessary to make evolution work and God's will and purpose actively direct evolution to his end.

He applied the calculus of probabilities which can mathematically express the idea of chance and figured out the probability of forming an imaginary protein molecule which is necessary for all living matter. If chance alone is considered the probability would be $2.02 \times 1/10^{321}$. Translating this into the volume required for the formation of a single molecule "the volume of substance necessary for such a probability to take place is beyond all imagination. It would be that of a sphere with a radius so large that light would take 10^{82} years to cover this distance. The volume is incomparably greater than that of the whole universe including the farthest galaxies, whose light take only 2×10^6 (two million years) to reach us."

"The probability for a single molecule . . . to be formed by action of chance and normal thermic agitation remains practically nil. Indeed if we suppose 500 trillion shakings per second we find that the time needed to form, on an average, one such molecule . . . in a material volume equal to that of our terrestrial globe is about 10^{243} years."

"But we must not forget that the earth has only existed for two billion years and that life appeared about one billion years ago, as soon as the earth cooled. . . ." [22] So with chance operating alone our earth is much too small and time is much too short to produce even a single protein molecule necessary for life.

Furthermore, Du Noüy points out that contrary to what is generally assumed that there is a smooth continuous progression from non-living to living, he finds not a smooth progression but very disturbing breaks. "Considering the scientific data, evolution as a whole is not intelligible unless we suppose some kind of finality—a goal to be attained. 'On an average' there is progress in one direction, and in that progress of evolution, mutation, adaptation, and natural selection are seen as its mechanisms. In themselves they are

[22] Du Noüy, Lecomte, *Human Destiny* (Longmans, Green and Co., 1947), 34.

not explanatory of evolution as a whole. An over-all finality or telefinality directed by an 'Idea, a Will, a supreme Intelligence' is all that can explain evolution as a line terminating in man." [23]

Here we see a scientist arguing to the existence of God by the fifth method of St. Thomas. He destroys the advocates of "chance" by meeting and defeating them on their own ground, and then from his studies concludes that a "Will and Supreme Intelligence" is working out its purpose in the world.

Few men have written so graphically and eloquently of how they have found nature to be a mirror of God as Dr. A. Cressy Morrison in his book, *Man Does Not Stand Alone.* He lists seven reasons why he believes in God. "First," he says, "by unwavering mathematical law we can prove that our universe was designed and executed by a great engineering Intelligence." [24] Then he gives numerous examples of the engineering skill that is built into the universe. The earth rotates on its axis at 1000 miles an hour, but if it turned at 100 miles an hour, the days and nights would be ten times as long, and the long, sunny day would burn off all vegetation and anything that survived that would freeze in the long night. The sun is our source of life and we are placed at such a distance from it that it warms us just enough and not too much. If it gave off only half its present heat we would freeze, and if half as much more, we would roast.

> The slant of the earth, tilted at an angle of 23 degrees, gives us our seasons; if it had not been so tilted, vapors from the oceans would move north and south, piling up for us continents of ice. If our moon was, say, only 50 thousand miles away instead of its actual distance, our tides would be so enormous that twice a day all continents would be submerged; even the mountains would soon be eroded away. If the crust of the earth had been only ten feet thicker, there would be no oxygen, without which animal life must die. . . . If our atmosphere had been much thinner, some of the meteors, now burned in space by the millions every day, would strike all parts of the earth setting fires everywhere."
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> Because of these and a host of other examples, there is not one chance in millions that life on our planet is an accident.[25]

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[23] Salmon, E. G., "Book Review of Human Destiny," *The Modern Schoolman,* Vol. 25, no. 1 (November 1947) 81.

[24] Morrison, A. Cressy, "Seven Reasons Why a Scientist Believes in God," *Reader's Digest,* Vol. 49, no. 296 (December 1946), 11.

[25] *Ibid.,* 12.

And so he goes through his seven reasons for his belief in God supplying countless examples of the wonders that the Creator has made in the universe, summing it all up in these words: "It is scientifically as well as imaginatively true, as the Psalmist said: 'The heavens declare the glory of God and the firmament showeth His handiwork." [26] This book is a striking example of what the Holy Father means when he says in the first part of his allocution that the "astronomical and the biological sciences, have in our day contributed to the argument from order . . . a vast array of knowledge . . ." and a "stupefying vision of the conceptual order animating the cosmos." [27]

Sir Edmund Whittaker

We might expect that very seldom a scientist would write a book dealing specifically with modern science and the Five Ways of St. Thomas. But that is what Sir Edmund Whittaker, a noted English scientist, does in his book, *Space and Spirit.* He reminds his readers that "the Five Ways start from our knowledge of the same universe that furnishes the subject-matter of modern physics. . . . Since the thirteenth century, when St. Thomas wrote, there have been profound changes in the conception of the material world, which have had repercussions on the philosophy of physics; fundamental notions such as those of matter, causality, and design have taken new forms, and consequently there have been changes in the states and interpretation of the initial assumptions from which his arguments proceed. . . . My object is to give some account of the history of the problem and to discuss the position as it stands today." [28]

He maintains that if St. Thomas lived today he would have built up from the data offered by modern science a powerful proof from the idea of creation. Sir Edmund cites the evidence for creation which we have already mentioned, the rushing away from us of the galaxies, concluding that if we reverse the process they must have been crowded together at some time in the past. After bringing forward other evidence he concludes

[26] *Ibid.,* 14.
[27] Pius XII, *op. cit.,* 184.
[28] Whittaker, Sir Edmund, *Space and Spirit* (Thomas Nelson and Sons Ltd., 1946), 3–4.

> that there was an epoch about 10 billion years ago, on the further side of which the cosmos, if it existed at all, existed in some form totally unlike anything known to us, so that it represents the ultimate limit of science. We may perhaps without impropriety refer to it as the creation. . . . From the point of view of natural theology, the insertion of a creation into the scientific picture of the cosmos is an event of immense importance. St. Thomas doubtless realized what a powerful argument for the existence of God could be built up if it could be shown by pure reason based on observation that the universe had a definite beginning in time. But in the 13th century scientific cosmogony was as yet unborn, as is well known. St. Thomas held that the belief of Christians in creation was based on revelation, and could not be established independently by the means of rational science.[29]

Sir Edmund emphasizes the contribution of science to the proof from design in these words: "The proof from order is today more complete, more comprehensive, and more majestic than in the form presented in the 13th century."

"Moreover," he says, "the fact which was not known to St. Thomas, that the same mathematical laws are valid over the cosmos, that it is shown by science to be interrelated and consistent, leads to the inference that there is only a single mind involved in the whole of creation; so that in this approach to the conception of God, modern science, by excluding polytheism, actually supplies a corollary to St. Thomas' proof." [30] These are but a few of the many remarkable and worthwhile observations Sir Edmund Whittaker has to make about the existence of God and modern science.

The Lesser Sciences

When we think of science leading to God, we usually have in mind the exact sciences of physics, chemistry, or astronomy. But there are the less exact sciences, like biology, geology, botany, etc., and these too can lead a person to God. The British author, Beverley Nichols, turned amateur botanist and found God when he planted a garden. For years he was an agnostic, but when he considered the evidence of nature he concluded that a man cannot be "at once a good gardener and a good atheist."

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[29] "Science Seeks Almighty God," *Catholic Digest,* Vol. 13, no. 1 (November 1948), 52–53.

[30] *Ibid.,* 55.

"To look into the heart of a rose," he wrote, "to praise its beauty, and in the next breath proclaim that the universe is a senseless chaos is surely the most naked example of a contradiction in terms. The gradual discovery, in flower upon lovely flower, the most exquisite and intricate patterns, had for me the quality of a religious revelation." [31]

Through the design he found in a simple daisy he was led to faith in a Master Designer. "I bought a magnifying glass, and late at night, in the lamplight, I would hold it over the daisy, with its thousand of close-packed stars, each crowned by a master craftsman with a tip of gold. I reveled in the rich fabrics of the iris, each petal a tapestry in miniature. The commonest objects were among the most exciting—the exquisite dispositions of seed-pods on the underside of a fern, like little buttons sewn on some miraculous jerkin." [32]

And while the sense of sight revealed a divine pattern, so the sense of sound suggested to him the possibility of a universal rhythm. "The very air was vibrant with music—the lovely legato phrases of the wind in the wheat, the brilliant arpeggios of a rainstorm, the rise and fall of the fluting birds. How was it possible, with all this music poured out so ceaselessly, that there should not be a major melody and a master musician." [33]

Truly nature is a mirror of God for any man if he will but think beyond the appearances. Francis Thompson wrote:

> One grass-blade in its veins
> Wisdom's whole flood contains. . . .
> O little blade, now vaunt
> Thee, and be arrogant!
> Tell the proud sun that he
> Sweated in shaping thee;
> Night, that she did unvest
> Her mooned and argent breast
> To suckle thee, Heaven fain
> Yearned over thee in rain,
> And with wide parent wing
> Shadowed thee, nested thing . . .
> Epitomized in thee
> Was the mystery

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[31] "Consider the Evidence," *Reader's Digest,* Vol. 58, no. 348 (April 1951), 91.

[32] *Ibid.,* 91.

[33] *Ibid.,* 91.

Which shakes the spheres conjoint—
God focussed to a point.[34]

The limit to which human reason aided by science can attain is knowledge of God as the creator of this universe. We have seen from the examples that scientists get only fragmentary pictures of God; as St. Paul says, they "see . . . through a mirror in an obscure manner." To know God more intimately the mind must be led by philosophy and revelation. Perhaps, for the scientist, this knowledge of God's wisdom and power mirrored in nature is but a step that must be taken along the road of knowledge that leads to God. Eventually, aided by revelation and divine grace, he will, like our Holy Father Francis, be able to lift the eyes of his soul to Brother Sun and see there an image and symbol of him who is called the "Sun of Justice." Like St. Francis, when he contemplates "Sister Water, so useful and humble and sweet and pure, and Brother Fire, so beautiful, joyful, and strong and mighty, and Mother Earth, so loving in her care of man and beast and herb and flower," [35] he will come to know the greatness, the goodness, and the love of God, the Father Almighty, Creator of heaven and earth, and Jesus Christ, His only Son.

DISCUSSION

AQUINAS THOMAS, S.A.:—The paper presented by Fr. Kieran Quinn is a fine summary, analysis and expansion of the Papal Allocution of our Holy Father to the Pontifical Academy of Science on November 22, 1951. It seems to me that the nature and title of the paper lead to some very important questions. In early Christian days, St. Paul concluded that every normal human being knows quite well that there is a God. In his recent work, Jacques Maritain indicates also certain pre-philosophical ways of approaching God. He indicates that this approach is doubly natural for first, it does not appeal to faith or revelation and secondly, it springs spontaneously from the unsophisticated mind's awareness of the existence of the world of other things and of its own existence confronting that world. These pre-philosophical ways are considered to lead to a valid and certain knowledge of God. The philosophical approach to God is then only one of the many ways of approaching the knowledge of God.

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[34] Thompson, Francis, *Complete Poetical Works* (The Modern Library Publishers, 1913), 355–356.

[35] Felder, Hilarin, O.F.M.Cap., *The Ideals of St. Francis of Assisi* (Benzinger Brothers, 1925), 426.

Nature as signifying the objects contemplated by the scientists certainly in some way mirrors the Creator because of their aspect of *vestigia* so eloquently described by St. Bonaventure in the *Breviloquim* and in the *Itinerarium Mentis Ad Deum*. Nevertheless, we particularly in Scholastic philosophy and theology must take care to realize that the scientific method can never lead to a philosophical or theological knowledge of the existence and nature of God in itself. Although, this statement may seem to be quite evident in theory, we find even in modern Scholastic circles, practical attempts to attain to a philosophical knowledge of God through scientific methods in the modern sense of the word science. For this, we have but to witness recent discussions in the American Philosophical Association, in their publication *New Scholasticism* and in the publication, *Modern Schoolman*.

The tendency evident among certain philosophers and Catholic scientists seems to indicate a mental confusion of the methods of science and philosophy. Such a confusion was warned against by our Holy Father in his address to the students of Rome University in 1952 where he pointed out that it is important that "methods of the science be applied only in the domain proper to it, namely, the 'sense world'; and secondly, that the existence of other realities beside those met with in natural science be recognised, more especially metaphysical realities which transcend the senses and depend on the universal laws of all-being." Actually, in its method, physical science depends upon metaphysics at least in the fact that it must pre-suppose the existence of universal laws of nature whose intimate nature can be investigated only by a philosophical science. An example of the tendency of some philosophers to be entrapped in the modern notion that the scientific method is valid in any study is the form sometimes given to the Cosmological argument for the existence of God. The argument is sometimes stated that if "A" has a cause and "B" has a cause and "C" has a cause, then all things of the same general nature, that is, all mutable things have a cause and therefore there must exist a first cause. This argument, in other words, is given in an extensive or expansive form which is proper to the simple enumeration basic to the inductive method proper to natural science. It is however certainly not an argument in an intensive form in which the very nature of a single object is the basis of the argument. The latter would be the proper philosophical manner of stating the cosmological argument.

Philosophy, however, if it is realistic, does proceed from the observation of certain sense data which surround us. Consequently, science is of value to philosophy insofar as it multiplies the amount of data upon which the philosopher may work. We must be careful however not to expect or to demand that scientists by using a scientific method should attain a philosophical knowledge of God. Science, insofar as it favors a respect for truth and for the human person and insofar as it strengthens the pre-philosophical notion of men in regard to God indicating in a detail manner that nature in some way is a mirror of God and insofar as it leads scientists to philosophize as indicated by our Holy Father in the beginning of his Allocution to the Scientists is of great value in the total question of man's attaining a knowledge of God.

It seems to me that we should discuss just what can be expected of a scientist qua-scientist in attaining a knowledge of God, his right or duty to proceed further from this point into philosophy, and the exact value of the information attained through his scientific work to the studies of philosophy

and theology. We are all aware that there is no grave problem here for those scientists who have been blessed with faith. Like our Holy Father St. Francis, their study of nature leads them to a deeper appreciation and a fuller realization of the greatness of God. Our concern in the discussion of these topics would be chiefly those who have not yet been blessed with faith but whom we must attempt both scholastically as well as ministerially to draw into the one true fold where their scientific knowledge can but lead them to higher spiritual planes.

SOME IMPACTS OF MODERN SCIENCE ON MORALITY

MATTHEW HERRON, T.O.R.

The marvelous extent, the depths to which Divine Providence has guided men of science to unlock the natural secrets of the material world for our comfort, ease, and material advancement should move all men to utter profound cries of gratitude to our Father in Heaven. The control and use of nature which has been achieved should draw all men closer to God. Reality, however, forces us to admit that the fears which Pope Pius XII uttered in his Christmas message of 1953 are well founded. Scientific achievements can and do give birth to a technological concept of life, as though it were the ultimate answer to the question of existence. In truth, the many and varied splendors of modern scientific achievements blind the minds of many men. They begin to believe the solution of all human problems lies in bending all scientific discoveries to create material prosperity for every man. They are too apt to believe an increase in productivity and an elevation in the standard of living form the ultimate goal of human life.

The most rabid materialist must be impressed by the great limitations which the atomic age has placed in focus. Dwarfing all our problems is the threat of total warfare which technical progress has made possible. The grave danger of an all-out atomic war spells out very clearly that the most important achievement in human progress is not man's mastery over matter but rather man's mastery over himself, which can be achieved only through submission to the will of God. Five years ago, in a paper read before this same group, I offered the suggestion that a just war is possible, even though not probable. A proportionate reason can exist which would justify the use of atomic weapons.

Since every just war is essentially a defensive action, those weapons may be used which are necessary for self-preservation. In a defensive action the principle of the two-fold effect is truly ob-

served as long as no more harm is inflicted upon the enemy than self-defense requires; but self survival may become impossible unless a nation uses atomic weapons. Conditions could arise which would justify the use of the atomic bomb or even the dreaded H-Bomb. If, tomorrow, an enemy nation, using nuclear weapons, were to destroy the entire Eastern Coast of our country, surely the government would not be obliged to sit back and wait until our enemies destroyed the entire country. I refuse to believe the use of the atom bomb has annihilated the right of a moral person to defend his existence.

A recent article in the *Clergy Review* sums up recent papal pronouncements. *Per se* it (A.B.C. warfare) can be justifiable in legitimate self-defense. But, as moralists have long insisted, it is not sufficient merely to have a just cause; two further conditions are required. The good which a war seeks to preserve or recover must outweigh the evil which it is likely to occasion. Moreover, no more violence may be used than is necessary to vindicate the right, and it must be directed only against unjust and violent aggressors. In pointing out that A.B.C. warfare can seldom be morally lawful, the Holy Father is not, therefore, enunciating a new principle. He is merely underlining the fact that, in practice, such warfare is more than unlikely to respect the conditions of the moral law.

Every dark cloud has a silver lining. A few decades ago, pseudo-scientists who commanded a hearing in the public press contemptuously laughed at the doctrine of the end of the world through fire. Today such men no longer laugh. They are looking for a Saviour. They realize that God has laid in the hands of men, themselves, the power to destroy the world by fire. A merciful God simply has permitted a scoffing world to see the temporal and frail nature of our earthly dwelling place.

The complaint is heard now and then that moralists change their opinions too often. And each time they insist they are absolutely right. I think we should all see that this is necessarily so. The solution of many moral problems is based upon our present knowledge of the natural law. If and when a particular branch of science discovers something new in the object and circumstance of a human act, moralists must consider, must examine the problem under the light of the new knowledge. Even the most eminent moral

theologian can only pass judgment upon a human act in accordance with the knowledge which natural and divine sciences provide here and now. New knowledge may change his judgment concerning the morality of an act. For example, we could not consider the morality of the rhythm method until the findings of Doctors Oginio and Knaus were authenticated. After medical specialists discovered the effect a fetus has upon an impregnated fallopian tube, we were forced to admit that conditions can exist which would permit its removal. Then, too, medical scientists, through their findings on the effect a punch on the head has upon the brain, have forced moralists to declare prize fighting is probably contrary to the natural law. Several years ago I attended a panel discussion on the morality of prize fighting. Out of the thirty-five qualified moral theologians who were present, only one rose to defend the morality of that sport as it is conducted today. Certainly the progress in the field of medicine and surgery forces us to admit that many procedures formerly called extraordinary means of preserving life must be called ordinary today.

The intrinsic problems in the field of morality which a priest faces demand a more profound and thorough training in fundamental moral theology. Many of the questions sent in to clerical quarterlies and monthlies demonstrate the need for a more profound grasp of fundamental principles. Clerical students need a thorough drilling in the principles and conditions necessary for the application of the two-fold effect. Certainly we must ever prudently distinguish the two verbs "can" and "may." We must ever be on guard against the constant invitations to substitute common sense for principle. Often the term "common sense" simply means the fallacy that the attainment of a good end justifies the use of any means. Outside the Church it is quite evident that any convenient end which can be achieved without difficulty is justified. The book *Medicine and Morals* by Joseph Fletcher is an outstanding example of confused thinking without any basis in principles of morality.

I do not think any of us will deny there is a great need for a competent man in the field of psychiatry who will make the data of his specialty available in a clear manner that the average priest can understand. We need not fear the true findings of this part of the science of medicine. We should look forward to the day when

someone uncovers the professional jargon and clearly shows what they investigate are impediments to human acts. They may and often do offer natural means to overcome ignorance, passion, force, fear, habit, and other obstacles they uncover.

We must be on guard and be ever mindful that our Faith is a reality to be lived. This presupposes the power of free will in a normal individual. It must insist upon the actual serious responsibility of man for his human acts. Any psychiatric doctrine which either explicitly or implicitly casts a doubt upon the reality of free will in a rational man must be firmly discarded as pernicious. We can always admit a mental aberration exists in a particular individual or that some impediment may prevent the use of free will, but free will is a reality.

The Holy Father in his remarks to the twenty-third annual convention of the International Commission of Criminal Police admonished us against any theory that would deny or minimize human responsibility. In part, he said, the agent is a man endowed with liberty—not a thing, not an automaton whose function would depend on some inanimate mechanism, nor a mere combination of feelings and impulses which would pass over the effect of instruction and appetite. Objective truth means also that man, in virtue of his natural faculties, enjoys the capacity of self-determination and must consequently be considered responsible for his determined acts, at least until the contrary is proved or until there is a well-founded doubt.

The age of automation which is all but upon us will surely create a thirty-hour work week. We, the spiritual leaders, must direct our people in the use of that increased leisure time. We must provide an appealing program of spiritual exercises. The Retreat Movement which has gained so much momentum in the past fifteen years is an encouraging sign—a step in the right direction. We must struggle, work, pray, and sacrifice to direct men in the use of their free time which scientific progress creates. Otherwise, automation will truly become a curse instead of a blessing. In the absence of extensive mental and physical labor, resulting from scientific progress, a greater need than ever has been created for mental prayer. We must devise means to teach men to live in the presence of God. Man's mind must be occupied, if not with supernatural realities, then with the forces of evil and temptation.

Even those who contend that the great social encyclicals of the past fifty years were merely exercises in papal penmanship must admit man's social nature requires him to unite with his fellowman to seek those things unattainable through his own effort. In this complicated industrial system, which *de facto* exists, in our scientific world, the ordinary employee rarely can demand justice on an individual basis. It would seem that the natural law, itself, demands he join in the formation of labor organizations or vocational associations to promote social justice.

The present Supreme Pontiff, Pius XII, has insisted time and time again upon the necessity of an organic conception of society. He demands the formation of the industrial council system as a step in that direction. The establishment of an organic society and industrial councils requires a wide unionization of labor, vocational and professional groups, as a basic foundation in order to operate effectively. The obligation to join a labor organization is a positive and general, not a universal, negative burden. There are exceptions, but I cannot see how we can deny the existence of the general obligation in our industrial civilization.

We, the divinely authorized teachers of the moral law, must instruct men in means to promote peace and justice in their organizations. We must direct them in promoting a common good. They must be taught not only to defend their own rights but they must be admonished concerning their grave obligation to advance the general welfare of whatever industry, business or profession in which they are engaged. Furthermore, they must be charged with the responsibility of promoting the common good of the nation. I do not think we need hesitate in stating that many obligations of a member of a union or a vocational group are parallel to the obligations of a citizen to his civil state. In both instances, vigilance and sacrifice are the price of the liberty, peace and justice. The unions keep shouting vigorously they want an honest pay for an honest day's work. We must have the courage to admonish them to demand their membership return an honest day's work for an honest day's pay. They must be made to realize the obligations to the employer who provides them with a means of sustenance. They must do their best to guard his assets and his property, upon which their welfare as well as his depends.

SCIENCE IN CATHOLIC GENERAL EDUCATION

VICTOR HERMANN, O.F.M.

Perhaps I should begin this discussion with an apology to the scientists present here. I am not a scientist in your sense of the term; I have never been one, though the field has not entirely escaped my notice—and that for two reasons. (1) I received my training for the priesthood in a Franciscan seminary that was sufficiently far-sighted to understand the importance of the study of science in relation to philosophy and theology and to the whole life of a priest; (2) I am a college dean and, as such, I have had a sufficient number of conflicts with scientists to enable me to speak at least somewhat generally on the subject assigned to me. Even though deans aren't supposed to know enough to be instructors, they deal with the problem of general education, and as they do they sometimes come to blows with students, faculty, department heads, even parents, and presidents.

A few months ago when I was preparing this discussion for the meeting at Rensselaer, a fellow English instructor asked me what I was doing. I told him as simply as I could that I was writing a paper for the Franciscan Educational Conference. "What about?" he asked. I told him. His answer: "I'm against it."

I don't believe that I have ever attended a single professional meeting on the subject of science and its general education value at which there were not undercurrents of similar conflicts over the position of science in the curriculum. Idealistic theorists rendered glowing accounts of what might or should be done; listening faculty members and administrative officers, more realistically inclined perhaps, almost unanimously countered with the question "How do you get your faculty to go along with those ideas?" The universal reply: "We don't; we're only a few dedicated souls."

I say these things not just for the laugh you may get out of them or for the familiar ring they may have to administrators and faculty

here present; they are actually a melancholy testimony to the confused thinking current both among scientists and among those responsible for programs of general or liberal education. Such conflicts are intensely human and will never be completely erased, but we can hope to arrive at a satisfactory solution only when scientists and liberal educationists begin to understand each other's goals.

The Harvard Report

Where does science fit in a program of Catholic general or better liberal education? If it fits, how should the courses be taught? From what viewpoint? Towards which goals? In the past ten years at least there have been numberless studies, some more penetrating than others, some serious and honest enough, others merely repeating what others had said before them—many of them floundering indeterminately in one direction or another.

The first of these studies within the past ten years, and still perhaps the most influential, the Harvard Report, began a discussion of science in general education with a clear recognition of the problem at hand. "Science means many things to many different persons,"

> To some it is typified primarily by the miracles of technology which have changed the face of civilization and which exert a continuing impact on all aspects of modern society. To others science signifies predominantly an intellectual enterprise marked by precision. . . . To still others it represents primarily a body of knowledge and hypotheses concerning the material world.[1]

The Report continued with the just remark that science partakes of all these things, but that it is "primarily a distinct type of intellectual enterprise, involving highly restricted aspects of reality and prepared as such to make particular types of contribution to general education." [2]

Science is not technology, though the two may develop in parallel, each fructifying the other. The primary end of science is knowing rather than doing, or perhaps, as the Report puts it, "it is doing in order that one may know," rather than doing with primarily such

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[1] *General Education in a Free Society,* (1945), pp. 150–151.

[2] *Ibid.,* p. 151.

pragmatic ends in view as greater convenience, technical efficiency, military power, or economic advantage.[3]

Science a Steppingstone

Or rather, going beyond the Report we are quoting, one may put it this way: science is doing in order that one may know the material world around us more accurately and by the more perfect knowledge gained be led behind the door to see also the perfection of the Creator of that world and thus be led to give Him the formal glory we owe as rational creatures. Thus behind every great act of scientific research God appears if we want to see Him, and thus too, the study of science becomes a steppingstone to the altar of God's infinite perfection. This is the ultimate or primary goal of the study of science: pragmatic ends—convenience, power, economic advantage—are only secondary or proximate aims and have little to do with liberal education as such.

More immediately or proximately science is distingushed by a persistent effort towards the academic discipline of precision. It measures what can be measured. To quote again from the Report at hand,

> When we say that science is concerned with things and events which permit exact definition and measurement, we imply a certain stability in these things and in their behavior. To a degree science limits its interest to the stable or repetitive. The material world abounds in such phenomena; yet it cannot be relied upon to produce them for inspection at times and under conditions which best satisfy scientific examination. The scientist therefore ensures himself, when he can, the proper circumstances for pursuing his inquiry by ordering the conditions of the natural event himself. This is the point of scientific experiment.[4]

And experiment in the field or in the laboratory is essential to scientific training even, it seems to me, for non-science majors—provided, of course, the work prescribed is not merely busy work designed to put in the required amount of time for the sake of credit hours. Laboratory work, if it is to be a real study, must provide "directly the materials of scientific argument and the tests of scientific hypothesis." Therefore, one of the real educational out-

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[3] *Ibid.*, p. 151.
[4] *Ibid.*, p. 151.

comes of the teaching of science at any level will also be a method of reasoning applicable *mutatis mutandis* to other fields of study as well. The habit of simple observation of reality (the first of Aristotle's intellectual virtues—understanding of first principles) leads directly to the second, the habit of *scientia* or science or the trained ability to draw careful conclusions from the facts with a certainty that can be proved or checked. Both these intellectual virtues are goals of the study of science at any level. When the student begins to put the facts and the conclusions drawn therefrom into the complete picture of an intelligently ordered universe, we begin to acquire the virtue of wisdom or *sapientia* as well. Science, therefore, has an important role in the liberal training of all of our students,—but not the heavily specialized course as it is sometimes conceived today, nor perhaps the so-called "broad survey" course which is often so wide that it covers only high-spots and achieves nothing because it has no basic organization, lacks depth, and tends to overemphasize factual information.

Ideal Science Course

At this point, perhaps, I should state what I believe to be the ideal science course designed to achieve the aims of liberal education. I have said that I am not a scientist. I prefer, therefore, to cite two viewpoints in reference to such a course and let the scientists carry on the work from that point. The first is from an unpublished Catholic university workshop manuscript, the second from an article by Sidney French, "Science in General Education." I am not completely satisfied with either.

> Natural sciences are accepted as an area of which the educated man must have some understanding, and here it is not practical to prescribe a single course for all. Certain fields of concentration need the support of one or other science for proper control of the material. Consequently a choice of biology, for example, in the case of concentrators in psychology, or chemistry for dietitians, must be permitted. Physics should not be taken until the sophomore year when the necessary tool of mathematics has been acquired.
>
> Frequently the criticism is made that introductory courses intended as a first step toward departmental specialization are not suitable for any but the prospective concentrator in the department; that such courses do not educate liberally. There are, however, values to be obtained beyond the acquisition of specific facts and information which belie this criticism; e.g.,

> experience of laboratory methods and training in exact procedure. These are concrete experiences with the method of science. If to these are added integrated lectures, demonstrations, or discussions on the nature, method and role of science, the layman should have received the broader values of this area, through the restricted material of an introductory course as through the "few relatively simple case histories" of Mr. Conant, or the general courses of the University of Chicago.
>
> The question of a different type of course for non-science concentrators, aimed at the interpretations of scientific references in literature and an understanding of the scope of science, is worth experimentation. You will find enthusiastic supporters for this among your students, if you are fortunate enough to have the type of instructor who is able and willing to handle it.

It is probably true that it may not be practical to prescribe a single course for all, but it is not so clear that the choice of science field must be mechanically determined by the pre-requisites of another field. The position of science in the curriculum must not be reduced to a mere pre-requisite. This view is still too pragmatic.

Sidney French expresses a point of view slightly different from the article referred to above.

> Survey courses in science have been tried in many ways and many places and with results that have been, on the whole, sufficiently encouraging to warrant further experimentation. Whether they are preferable to the more traditional distributive requirement of a laboratory course in some one science field is a matter over which teachers of science will argue everlastingly, and it is not the object here to belabor these arguments unnecessarily. It must be said, however, that there is little social, philosophical, or educational justification for a distributive requirement which merely exposes the nonscientist to the basic course of a science designed primarily for technical training. Nor does the student in such courses learn, except incidentally, anything of the great historical and contemporary impact of science on civilization.
>
> Many teachers of science have, of necessity, become so concerned with the technical training aspects and technical importance of science today that they have had to forget their heritage of natural philosophy. It is high time we quit trying to sell science as a technique to those who have no wish or need to become technicians. It is even higher time, in the atomic age, to sell science as a part of the glorious but dangerous heritage of civilization, as a way of approaching problems which have altered and will alter our ways of life so rapidly and profoundly that humanity is unable to make the necessary adjustments. If the scientist does not tackle this vital problem, someone else will. If the scientist is going to tackle this problem, he must, for this purpose, make a clean break with traditional content and methods; he can no longer ignore the history of science as he has habitually; he can no longer argue that an understanding of the methods and the significance of science can only be undertaken after

extensive and intensive training in the language and techniques; he must no longer substitute the symbols for the body.

This statement is less practical, more idealistic but it has much in it that is sound. Many scientists, however, will brush it aside because it means a real break with the usual mode of presentation. Whether we take this view or any other, it seems clear that science must be able to justify itself in its own right in the curriculum. It must not be regarded just as a pre-requisite or as a relatively unimportant tool. There must be as much reason for the science course in the curriculum as there is for any other requirement unless it be philosophy or theology.

The theme of this paper, however, centers about a specific kind of general or liberal education which we have labeled Catholic. Much of what is said, therefore, in the third part of this paper must somehow be related to that label. Will what has been said be any different because we have inserted the term "Catholic" into our thesis? The answer to this question must inevitably be linked with our own concept of Catholic education as a whole, and this concept it seems to me must include training in science in some way, else it would be incomplete. Is the school or college, as Dewey and his followers would have it, a mere training ground for social adjustment? Or, as others say, for democracy? For citizenship? For economic gain? For physical culture, or even for moral virtue? At some time or another in the past and the present all of these goals have been proposed individually and collectively for the teacher, for the curriculum, for the school or college. If these were all final goals or primary ends, then science would belong in the curriculum only in so far as it promoted one of them. Actually all of these aims can claim to be of immeasurable value as by-products of a school that does the school's primary work—and that work is primarily the communication and the pursuit of knowledge and of the truth. Science is part of the vast field of knowledge, part of the truth and as such it must be there. To put it another way a school is an agency for teaching; its primary function is the intellectual development of its students. The chief aim, therefore, of the Catholic school is the formation, under Catholic auspices, of what has been called "the Catholic intelligence," not democracy, nor adjustment, nor citizenship, and the like.

> By the great teachers of the Christian past, knowledge has always been regarded as a good, as natural and necessary to the mind as food and clothing to the body. For us who struggle to augment that tradition, it should no longer be necessary to argue the excellence of knowledge, not merely as an individual perfection but even as a measure of our very civilization. Every master idea in our western institutions—in our government, our law, our economic organization, in the representations of our visual and literary arts, even in our machinery—was first formulated as knowledge and transmitted by our schools. Thousands of years ago on this earth, everything necessary for the release of atomic energy was present—everything that is with but one exception, the knowledge. Civilization cannot survive where the excellence of knowledge is turned into a mere handle for pragmatic ends, even if those ends be democracy itself. Where, as in some recent views of education, the school condemns knowledge to be a mere bond-servant of political and social causes,[20] not only does the school fail in the school's task, but the very civilization that makes possible the school is itself in peril. Nothing save knowledge is truly teachable, and where the school surrenders the primacy of knowledge, it will finally lose its own priceless premise—the truth that makes its teaching free.[5]

Without science part of the great body of that "truth which makes us free" would be missing; the physical and biological world around us, would be neglected—the world which has been placed here that *in it* man might learn to see more and more of the Creator and from that vision know, and knowing love, and loving serve—and, we might add to complete the picture, thereby fulfill his primary purpose on earth and attain his final end hereafter.

The study of science, therefore, opens wide a great field of study, a rich area of human experience, the wide world of physical reality; if done rightly, it is a persistent effort towards the discipline of precision as it is towards critical appreciation of the results achieved by persistent research. Above all, in harmony with the theme of this conference, it is a study which without making a special effort, without preaching a sermon or making a meditation, leads directly to God. Nature is the mirror of His perfection; nature is the mirror of God. No rational creature, no Catholic and certainly no Franciscan who is worthy of the name can observe nature, draw conclusions from the facts observed, without finally understanding what St. Francis so thoroughly felt when he sang his canticle of the sun.

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[5] Vincent E. Smith, "The Catholic School: A Re-examination," NCEA Convention (1955).

But all men are vain, in whom there is not the knowledge of God: and who by these good things that are seen, could not understand him that is, neither by attending to the works have acknowledged who was the workman:

But have imagined either the fire, or the wind, or the swift air, or the circle of the stars, or the great water, or the sun and moon, to be the gods that rule the world.

With whose beauty, if they, being delighted, took them to be gods: let them know how much the Lord of them is more beautiful than they: for the first author of beauty made all those things. For if they were able to know so much as to make a judgment of the world: how did they not more easily find out the Lord thereof? [6]

[6] *Wisdom,* xiii, 1–3; 9.

A SUGGESTED COURSE IN PHYSICAL SCIENCE FOR THE MINOR SEMINARY

VICTOR SCHOENBERGER, O.F.M.Conv.

Introduction

The course which is outlined here is already in use at Saint Francis Seminary, Staten Island, New York.[1] This course has been organized with the aims and objectives of the minor seminary in mind. It is based on a particular textbook, but much additional material, useful to both teacher and student, has been added to attain the course objectives, particularly preparation in the field of physical science for the study of philosophy, for "the philosopher must know scientific facts." [2] As was said at a conference on the curriculum of the minor seminary, such a course should be a source of scientific knowledge which stresses the "relation science has to other fields and the impact it is having on modern thought." [3]

Science affects, and to a certain extent molds your life and mine. It is no longer a mysterious ivory-tower process proper only to a few. It is not an "indifferent field, but . . . a field that must be captured and controlled for Christ; for it is our greatest danger, our greatest heresy if you will." [4] That is why the Third Plenary Council of Baltimore provided for instruction in the natural sciences in the minor seminary, when legislating for the United States in response to the traditional mind of the Church as voiced in Canon Law.[5]

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[1] Saint Francis Seminary, Todt Hill Road, Staten Island, New York, Minor Seminary of the Immaculate Conception Province, Order of Friars Minor Conventual.

[2] Brother Benignus, F.S.C., *Nature, Knowledge, and God* (Milwaukee: The Bruce Publishing Company, 1949), p. 131.

[3] Reverend Henry E. Wachowski, "Science in the Minor Seminary Curriculum," *Proceedings of a Conference on the Curriculum of the Minor Seminary, Conducted at the Catholic University of America,* ed. Reverend Michael J. McKeough, O. Praem. (Washington, D. C.: The Catholic University of America Press, 1952), p. 79.

[4] *Ibid.,* p. 78.

[5] Reverend John Rogg Schmidt, "The Law of the Church Regarding the

This paper outlines a two semester course for students of the first year college level. The topics selected for the first semester are from physics, astronomy and astrophysics, while those selected for the second semester are from the principles of chemistry, organic chemistry and earth science. There are four periods a week of fifty minutes each. Demonstrations, field activities and laboratory experiments, such as time permits, are heartily recommended, as they help to drive home important principles and facts, but by reason of the study load of the students no additional time is allotted for these activities. It is recommended that three periods a week be used for lecture, while the fourth be set aside for seminars at which students' papers are read, tests or demonstrations.

The Objectives of the Course

The objectives of the course, based on the foregoing statements, are (1) to provide a sound background in physical science which will be helpful in philosophy, (2) to demonstrate the reflection of God in nature, (3) to provide a certain basic knowledge for later application of moral principles to cases arising from modern science,[6] and (4) to increase general cultural background and interest.

These objectives have governed the choice of the topics and differentiate the course from the survey type of course given in many liberal arts colleges. The treatment is for the most part non-mathematical, descriptive, and stresses the principles of physical science. Some knowledge of high school physics and chemistry is presupposed, but students who lack this background might be given reading assignments in basic nomenclature, simple machines, chemical symbols or the naming of compounds, etc., as part of the student reading program. The number of topics selected for the course is purposely limited to fulfill the course objectives and to allow for some degree of concentration on the topics selected.

Minor Seminary Curriculum," *Proceedings of a Conference on the Curriculum of the Minor Seminary, Conducted at the Catholic University of America,* ed. Reverend Michael J. McKeough, O. Praem. (Washington, D. C.: The Catholic University of America Press, 1952), p. 14.

[6] Monsignor Ronald A. Knox, *God and the Atom* (London: Sheed and Ward, 1945), p. 65ff.

The Student Reading Program

As an aid to achieving the purpose of the course, a student reading plan is recommended. As Father Campbell has pointed out, this also encourages the student to study for himself, which he should be able to do on the college level.[7]

At the beginning of the first semester a list with a wide selection of science books from the seminary library is distributed to the students. Each student is to read and report on one book of his own choice. This is a six weeks' assignment coinciding with the first marking period. The purpose of this first assignment is to stimulate interest in some phase of science.

The second assignment is a report on a specific subject rather than a book report. In some cases the student may want to develop some subject from his previous book report. In other instances he may want to choose an entirely new subject. Whatever the case might be, the purpose is to start the student on an elementary library research project. Six weeks are allowed for this report.

During the second semester, somewhat more advanced topics are assigned, and with less choice on the part of the student. Some suggested topics are: science history, light and optics, weather (which is omitted in our outline of the course itself), herbs, tides, the radio telescope, etc. For the more capable students an opportunity to integrate science and philosophy is provided in such topics as the historical ideas of space, time and motion, the physical idea of substance, and the evolution of the earth.

This program is brought to fruition in the reading and discussion of the papers in the occasional seminars suggested.

Topics Selected for the Course

The following topical list, based on the *Fundamentals of Physical Science,* by Konrad Bates Krauskopf, third edition (McGraw-Hill Book Company, New York, 1953), outlines the course. This is the text used for the course.

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[7] Very Reverend James Marshall Campbell, "The Curriculum of the Minor Seminary," *Proceedings of a Conference on the Organization and Administration of the Minor Seminary, Conducted at the Catholic University of America,* ed. Roy J. Defarrari (Washington, D. C.: The Catholic University of America Press, 1951), p. 59.

1st Semester	Lecture Periods
I. The Solar System	
A. The Theories of Ptolemy and Copernicus	3
B. The Planetary System	3
C. Development of the law of gravitation	6
D. Theories of the origin of the solar system	2
II. The Universe	
A. Fact and Theory	6
III. The Structure of Matter	
A. Electricity and Magnetism	2
B. The Electron	2
C. Radiation	6
D. The Atom and Atomic Energy	4
2nd Semester	
IV. Matter and Chemical Energy	
A. Energy	3
B. The States of Matter	3
C. The Kinetic Theory	3
D. The Atomic Theory of Chemistry	6
E. The Periodic Law	2
V. Fundamental Chemical Processes	
A. Ionic Substances and Their Reactions	4
B. Principles of Reactions	4
C. Carbon Compounds	2
VI. Earth Science	
A. Structure of the Earth	2
B. Rocks and Minerals	2
C. Erosion and Sedimentation	3
D. Vulcanism and Diastrophism	3
E. Earth History	3
	74

Explanation of the Outline

The outline varies somewhat from the index and arrangement of the text, because the solar system, the universe and the structure of matter are more properly in the realm of physics and therefore are treated together. This constitutes the first semester's work. The

units on matter and chemical energy, fundamental chemical processes and earth science are treated as the chemical part of the course and constitute the work of the second semester.

To give an idea of how this course was handled in practice each topic of the outline is considered here. The titles below are the six major topics of the outline. In general, the paragraphs under the titles contain suggestions, references and points to be stressed. By reason of the necessary brevity of the paper they do not contain a complete discussion of the topic.

The Solar System

The first topic of the course, the solar system, affords an opportunity to use the historical approach to the teaching of science advocated by J. B. Conant.[8] This is sometimes a useful method because history generally leads us along a path that proceeds from the simple to the complex. The "Earth-centered Hypothesis" of Ptolemy was one of the first scientific explanations for the movement of the planets which later gave way historically to the theory of Copernicus. Although this is hardly proceeding from the simple to the complex, nevertheless it does follow a useful historical sequence.

The affirmation of the Copernican system through the efforts of Brahe, Kepler and Galileo represent a major victory for the use of the inductive method in science. This subject is well treated in Father Bittle's book, *The Science of Correct Thinking*, and a brief explanation of the elements of induction would be helpful both in natural science and philosophy.[9]

During this part of the course an excellent way to stir up interest is to assemble, as a class project, or at least to use, an astronomical telescope. There are few students who do not wax enthusiastic about science when given an opportunity to view our nearest neighbor in the sky, or perhaps some planet. The exasperating labor required in former years to grind the mirror of a reflecting telescope is no longer a valid reason for not "building your own" because there are a

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[8] James B. Conant, *On Understanding Science* (New Haven: Yale University Press, 1947), p. 12.

[9] Celestine N. Bittle, O.F.M.Cap., *The Science of Correct Thinking* (Milwaukee: The Bruce Publishing Company, 1944), pp. 296–319.

number of supply houses which sell ground and polished spherical mirrors at very reasonable prices.[10] If the seminary is located near a planetarium a visit there would make an appropriate field trip at this time.

The relative size of the planetary system, the orbits of the planets, and some valuable material on the universe is well illustrated in "The World We Live In" series of *Life* magazine.[11] The editor of this series is Lincoln Barnett, the author of *The Universe and Dr. Einstein,* and it represents the contributions of some of the most outstanding scientists of the country.[12] This is a source of excellent material for both teacher and student use.

Our Holy Father, Pope Pius XII, in his address to the Pontifical Academy of Science on November 22, 1951, entitled "Modern Science and the Existence of God," pointed out that science is in a position to help determine whether or not the proofs of Saint Thomas for the existence of God, particularly those of motion and order, are strengthened or weakened by its progress. After considering certain aspects of the macrocosm and the microcosm, he came to the conclusion that modern science has provided an "inexhaustible mine" for bolstering but not for completing the foundation of the argument for God's existence.[13] Here we have the example of science in its proper position as a handmaid of philosophy as well as the encouraging recognition of the necessity of scientific knowledge for progress in philosophical thought. This was one of many occasions on which the present Holy Father spoke on science.[14]

The treatment of the law of gravitation is one of the main opportunities to show the inter-dependence of science and mathematics. Since this represents a big step for students in the minor

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[10] Harry Ross, Scientific and Laboratory Apparatus, 70 West Broadway, New York 7, N. Y. A three inch spherical mirror, ground and polished, with construction instructions and the other necessary optical parts, $7.00. Other kits more expensive in proportion to mirror size.

[11] "The World We Live In": Part XIII, "The Star-studded Reaches of Measureless Space," *Life* (December 20, 1954), pp. 44–70.

[12] Lincoln Barnett, *The Universe and Dr. Einstein* (New York: William Sloane Associates, 1950).

[13] Pope Pius XII, "Modern Science and the Existence of God," *The Church and Modern Science* (New York: America Press, 1951), pp. 31–48.

[14] Sister Mary Ignatia, I.H.M., "Pius XII, Science and Scientists," *The Science Counselor,* XV (March, 1952), p. 23ff.

seminary, considerable time is spent preparing for the derivation of the matematical formula by a thorough review of proportion, the meaning of equations, force and motion. Only then can one expect an understanding of Newton's Law of Gravitation.

At a recent symposium on the utilization of solar energy it was reported that our nuclear fuels will last only 150–200 years and that a solar furnace has reached the temperature of 4400 degrees centigrade. This shows that even though we depend on the sun for each moment of our existence, posterity will probably be far more dependent on the sun than we are for heat and energy.[15]

The sun is no less important historically, for all the theories of the origin of the solar system are centered about the sun. These should be well covered in the course, because of the applications to cosmology.[16]

The Universe

The instruments used by the astronomer are the starting point in the treatment of the universe. These include telescopes of the reflecting type and the refracting type. If the students have built their own they should already have a grasp of the principles involved, because their's is a miniature edition of the 200 inch Mount Palomar telescope! Most students are surprised to hear that the modern professional astronomer does not spend long hours each night peering through the eyepiece of a telescope but depends on the records of the camera and spectroscope for his information, which he studies minutely during the daytime! It is also a source of wonder to the students that the astronomer can tell whether a star is approaching the earth or receding from it by reading the star's spectra. One of the most recent instruments developed to study the far reaches of the universe is the "radio telescope," which is described mainly in periodical literature.[17]

The *Life* series previously cited is even more important here.[18]

[15] "News and Notes," *Science,* CXIX (January 15, 1954), pp. 82–3.

[16] Nicholas D. Cheronis, James B. Parsons, and Conrad E. Ronneberg. *The Study of the Physical World* (New York: Houghton Mifflin Company, 1950), pp. 828–46.

[17] John D. Kraus, "Radio Telescopes," *Scientific American,* 192:3 (March, 1955), pp. 36–43.

[18] "The World We Live In": Part XIII, "The Star-studded Reaches of Measureless Space," *Life,* (December 20, 1954), pp. 44–70.

For example, it dramatically points out that our solar system is only one infinitesimal point in a huge island of stars called the Milky Way, with dimensions 100,000 light years across and 10,000 light years deep. What an opportunity to impress the students with the infinite gulf between creature and Creator, the omniscience of God in the design of the cosmos, and the "footprints of God" among the stars, apparent to all but the intellectually proud, self-sufficient, atheistic pseudo-scientists. It is here that the student comes face to face with the most spectacular evidence for the argument of God's existence from the design of the universe, and no doubt this is what our Holy Father meant when he said that science, with its magnificent progress, has a wonderful opportunity to improve on the physical foundations of some of the arguments of Saint Thomas for God's existence.[19]

Space and the expanding universe have been the subject of much speculation. The theories of Dr. George Gamow and Dr. Milton Humason are discussed in the *Life* series by these eminent scientists themselves along with a host of other outstanding men.[20] The article is particularly useful for students. Teachers of the course will find the subject more fully developed in *Concepts of Space* by Jammer.[21]

The Structure of Matter

To adequately comprehend the basic theories of the physical structure of matter, a knowledge of static electricity and fundamental magnetism is necessary. Demonstration experiments in accompaniment with the lecture are highly recommended. Also, the relationship between electricity, magnetism and matter is nicely illustrated in a filmstrip produced by *Life*.[22]

Current electricity is studied next. Because of the practical aspects considered the students generally find it interesting and useful to work out problems involving Ohm's Law, electrical power, transformers, and household circuitry. To illustrate the last point, which applies to churches and friaries as well as to homes, the local

[19] Pope Pius XII, *op. cit.*, p. 35.
[20] *Life, op. cit.*, p. 64.
[21] Max Jammer, *Concepts of Space* (Cambridge: Harvard University Press, 1954).
[22] "The Atom," a filmstrip, (New York: *Life* Filmstrips).

power company probably can supply a film on adequate household wiring and fusing, as it did here last year.[23]

Some properties of electrons can be demonstrated with a cathode ray oscilloscope. While this instrument might be regarded as a luxury in the minor seminary it has uses in the physics course as well as in this one. Also, some of the reasonably priced kits for building it yourself make it worth while.[24]

The electron and much other material on the structure of matter are well explained and illustrated in the five filmstrips entitled *Atomic Physics*.[25]

"As the symphonies written and unwritten are in the vibrations of the orchestral instrument—So are the harmonies of all Nature in the vibrations of the universe." [26] This quotation taken from the manual of "The Chart of Electromagnetic Radiations" brings out the fundamental unity existing between electric waves, radio waves, heat waves, ultraviolet waves, X rays, gamma rays and secondary cosmic rays. The use of this chart has proved to be a most effective way to teach the principles and properties of radiation. The advantage of this chart is that it gives a total picture of radiation and lets the student see that these waves are basically all the same. If the seminary has an amateur radio station as ours does, the students can observe the practical applications of radiation at first hand.

The atom is the "crux" of the study of matter. Later, in the chemical part of the course, combinations of atoms forming molecules and compounds are considered, but here we are considering

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[23] Consolidated Edison, New York, N. Y.

[24] Heath Company, Benton Harbor, Michigan. Three inch oscilloscope kit, $29.50. Others proportionally higher according to size.

[25] "Atomic Physics," a series of five filmstrips:

Part I The Electron.
Part II Rays From Atoms.
Part III Nuclear Structure.
Part IV Atom Smashing.
Part V Uranium Fission.

These are in black and white, and range from 26 to 41 frames. Guide book included. Published 1949. Price $3.00 each. Educational Film Department, United World Films, 1445 Park Avenue, New York 29, N. Y.

[26] "A Key for Use with the Chart of Electromagnetic Radiations" (Chicago: W. M. Welsh Scientific Company, 1951), Front Cover.

the atom from the physical and nuclear standpoint. In this connection attention is called to the titles under the "Teachers' Reference and Reading List," following the text of the paper.

The Effects of Atomic Weapons, an Atomic Energy Commission Document, is a thorough treatment of the disastrous effects of the fission type atomic bomb. This subject would seem to warrant some treatment because of the later consideration of the moral problems deriving from nuclear weapons.[27]

Matter and Chemical Energy

Matter and energy are closely related in chemistry. And it is important that the student be able to distinguish between the various types of energy. For instance, the battery in your car produces electrical energy for the starter, the ignition system, the lights and the horn. But the blowout in your tire is also the result of energy! The first is a well ordered chemical reaction taking place in the battery itself, whereas the second is the result of a disordered expansion of a gas due to the heat of friction between the individual molecules, and is what we might call a physical reaction.

How often do students mistake the freezing of water for a chemical change and the burning of wood for a physical change! Sometimes they call air a compound and water an element. This would indicate the necessity of stressing the fundamentals of the states of matter, the distinction between atoms and molecules, elements and compounds. This might seem elementary and indeed it is, but if the students are to grasp the full implications of the philosophical concepts of substance and accident, etc., they must learn the fundamentals.

A discussion of the gaseous state and the kinetic theory of gases would seem to be the best approach to a consideration of the states of matter. That is the method of Sir William Bragg in his classical volume, *Concerning the Nature of Things.*[28] While students who have had high school chemistry have been "exposed" to the laws of definite proportions, multiple proportions, and the conservation of

[27] "The Effects of Atomic Weapons" (Washington: U. S. Government Printing Office, 1950). Price, $1.25, paper bound.

[28] Sir William Bragg, *Concerning the Nature of Things* (New York: Dover Publications, 1954), Price, $1.25, paper.

matter, a thorough understanding of these principles makes for a better understanding of substantial change when treated in philosophy.

The ordered progression of more than ninety elements in nature, as illustrated by the periodic table, give irrefutable evidence to the argument for an Intelligent Designer. As the student comes to see for himself the systematic build-up of the elements in nature, it becomes increasingly difficult not to discern the guiding hand of an omnipotent and all-knowing Creator behind it all. This conclusion, drawn not only from the evidence given by the orderliness of the periodic table of the elements, but also from the evidence in all nature, has been called "the most wonderful fact of the universe." [29]

Fundamental Chemical Processes

Some psychologists have found by experiment that 0.007 of a gram of hydrochloric acid in 100 cubic centimeters of water, on the border of the tongue is needed to produce a threshold sensation of acid, and 0.50 of a gram of sugar in 100 cubic centimeters of water on the tip of the tongue are needed to produce a threshold sensation of sweetness.[30] These are the findings of empirical psychology and they point out the necessity of having some understanding of solutions. Such knowledge is also necessary for the proper consideration of the reactions of ionic substances which follows.

Not all chemical reactions are as complete and final as the burning of wood, where the ashes give very apparent evidence of a change in substance. In some ionic reactions, such as the neutralization of an acid, an equilibrium is reached, with an exchange of ions between the substances taking place at an equal rate in both directions of the reaction. But there is no apparent change of substance!

Besides these ionic reactions with their tendency to reach a stage of equilibrium, there are those which require considerable energy to activate the reaction, such as in the burning of coal. Then there are those reactions which liberate large quantities of energy, once

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[29] Henry V. Gill, S.J., *Fact and Fiction in Modern Science* (New York: Fordham University Press, 1944), pp. 120–131.

[30] Timothy J. Gannon, *Psychology, The Unity of Human Behaviour* (Boston: Ginn and Company, 1954), p. 84, citing *A Textbook of Physiology,* p. 286.

the process starts, as when magnesium ribbon burns. Any consideration of the principles of chemical reactions would include all of these types of reactions.

There are more than ten times as many carbon compounds as there are of all other known compounds. We are in contact with many of them each day, in the form of food, fuel, drugs, plastics, etc., which would warrant treatment of this subject, not so much for the philosophical background as for general cultural background.

Earth Science

Much of the material treated in the previous units is applicable here, and in fact constitutes a necessary foundation for this unit. In the light of the above statement we might say that the atmosphere is a mixture of gases, the hydrosphere is a huge solution covering four-fifths of the earth's surface, and the lithosphere is a veritable gold mine of solid elements and compounds found as minerals, rocks and soil.

The subject of rocks and minerals is frequently treated scantily. And yet there is ample material on the local scene to make the study interesting. In fact, it has been said that the difference between making a course like this a course "in science" rather than "about science" lies in the resourceful use of local materials.[31] For example, a recent newspaper article entitled "Geologist Can Be Happy Here," gives a quick summary of the geological history of the Staten Island area.[32] It is the kind of article which lends encouragement and enthusiasm to one teaching a course such as this.

Though erosion has produced such scenic beauties as the Grand Canyon, nevertheless the erosion afflicting our western states at the present time is a serious agricultural problem. We should be appreciative of the fact that the face of nature is continually changing and of the problems that man has to face in the areas affected.

Vulcanism involves the movement of liquid rock in the earth, and diastrophism involves the movement of the solid materials of the earth's crust. These processes introduce us to some of the unsolved

[31] William E. Morrell, "Laboratory Work in a Physical Science Course," *Journal of Chemical Education,* XXX (February, 1953), p. 80.

[32] Lee A. Ellison, "Geologist Can Be Happy Here," *The Staten Island Advance,* January 22, 1955.

problems of geology. For example, where does the liquid rock come from? And how does it work its way to the crust?

Ages ago the underground storage areas for petroleum and natural gas were happily formed by diastrophic movement of the earth, making possible, ultimately, the machine age. This also is well treated in the *Life* series (Part III).[33] It is also available as a filmstrip.[34]

Establishing the age of the earth is perhaps the most fascinating question in treating the history of the earth. Most methods used in the past have proven faulty, but the method involving the radioactive decay of Uranium 238 to Lead seems to be the most accurate. The *Life* series (Part I) is valuable here.[35] It is likewise available as a filmstrip.[36]

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[33] "The World We Live In": Part III, "The Face of the Land," *Life,* (April 13, 1953), available as reprints from *Life* Magazine, Department W, 9 Rockefeller Plaza, New York 20, New York.

[34] "The World We Live In": Part III, "The Face of the Land," a filmstrip, in color, with lecture notes, available from *Life* Filmstrips, 9 Rockefeller Plaza, New York 20, N. Y. The eight parts of this series are available at $6.00 each.

[35] "The World We Live In": Part I, "The Earth is Born," *Life* (December 8, 1952), in reprint form.

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THE TEACHING OF THE SCIENCES IN CATHOLIC COLLEGES

PHILOTHEUS BOEHNER, O.F.M.

We are living in an age that is molded and guided by the sciences. From a Christian point of view, the situation must be considered critical; for our whole Catholic thought and way of life are being completely ignored or questioned or even violently attacked by certain scientists. It is of no avail to say that there are also Catholic scientists, and those of the highest rank. It is useless to tell us that in themselves the sciences are not in real opposition to Christianity and Catholicism. We firmly believe that that is known quite well. But that is not the point at all.

The sciences have become a world-power of the first order. Under their dominion a new world has been shaped; a new outlook on life is in vogue; mighty revolutions and ideologies have been conceived under their influence and inspiration. Is it necessary to say here that mechanistic and materialistic Communism has its root in the mechanism of classical physics and chemistry? Is it necessary to point out that the myth of the twentieth century with its racialistic ideology of soil and blood has its roots in the biological theory of genetics and to a great extent in Galton's eugenics? In short, the sciences have become a factor of the first order in culture and civilization, in religion and philosophy, and in this atomic age the main factor in politics. Who would have dreamed that scholars, such as these, who are usually considered impractical, would be eagerly sought by governments?

It is a fact useless to deny that the sciences have been drifting away from everything our religion stands for; and it is a sad fact that some teachers of the sciences are responsible for the loss of these highest values in many a young man. This loss of the supreme values has been effected in two ways: first, by overt malice on the part of some teachers and scholars who with biting sarcasm were able to destroy and undermine religion; secondly, and perhaps

mainly, by the fact that the religious sphere simply does not exist for these men. To ignore is oftentimes the best method of killing something.

It is obvious, then, that a heavy responsibility burdens the shoulders of the Catholic scientist and science teacher. His task cannot be merely the negative and defensive one of beating back the attacks of atheistic and anti-Christian scientists. He must do more. He must go over to the offensive, take away from the enemy the weapon used for destruction, and employ this weapon for construction. He must do the same as the Fathers of the Church did with Greek speculation; the same as the great Scholastics did with the onrushing Greco-Arabian philosophy and science in the thirteenth century. The same task again awaits us. The problem is not yet solved, and cannot be solved in a negative way. It has not yet been solved in philosophy in the spirit of the great masters, nor has it been solved in the sciences.

I. Negative Clarification

Before advancing any positive suggestion, may I indicate two ways in which such rapprochement should not be attempted. On the one hand, we should not refuse to alter outmoded Scholastic notions, be they scientific or philosophical; on the other hand, we must not confuse the spheres of faith and of science.

1. Some seem, in practice if not in principle, to consider every philosophical utterance of the Scholastics as sacrosanct. In the findings of modern science they seek only confirmation of medieval notions.

Saint Albert the Great and Saint Thomas integrated the immense body of Graeco-Arabian knowledge, including the sciences, into a Christian synthesis. This they did, not by leaving the traditional philosophy as it was and contorting the findings and theories of pagan philosophers into the frame of their own time-honored philosophy. These masters had the courage to remold their whole philosophy and in consequence gave us a real and new synthesis, that is still the admiration of millions. Now, we must do the same in our times. In the spirit of these masters and with all reverence we have the task of integrating into our own philosophy the findings of our

own modern sciences; but not by declaring sacrosanct anything stated by the great Scholastics. We must effect this integration by a critical examination of their theories in the light of modern discovery. This is precisely what Leo XIII requested when he wrote: "In this regard it is well to note that it is highly unjust to blame this same philosophy for being opposed to the progress and advancement of the natural sciences. We have in mind the wisdom of Saint Thomas: if any matter is searched out by learned schoolmen through an excess of subtlety or taught after too little examination, if any matter is not in accord with the considered teachings of a former time or is in any way undemonstrable, that matter we are by no means inclined to present to our age for imitation." (Ed. Leonina, Vol. I, P. XV, 1882.)

Hence we should not ask the scientist to prove everything that the great Doctor of the Church has taught. On the contrary, we should openly admit that the biology and physics of the Scholastics need substantial changes. We should not blandly ignore their teachings on nature; nor should we be driven by so much fear and reverence as to associate modern teachings and medieval hypothesis in a strange *mixtum compositum.*

2. On the other hand, we must not confuse the spheres of faith and science. We are not advocating a Catholic physics, a Catholic chemistry, a Catholic biology, and so on. We do not believe in such Catholic sciences any more than we believe in a Catholic philosophy in a systematic sense. Historically, there has been a Christian philosophy, developed under the influence of revelation. Systematically, everything must be proven from naturally known premises. Whatever goes back, directly or indirectly, to revelation through a chain of reasoning is a matter of faith and belongs to theology. Our sciences must stay outside of theology. They share their means of information and methods with any other purely human research. The findings in biology, for instance, are to be obtained by means of observation and experiment. They can be made by any human being, whether he be a believer or not.

If the Catholic scientist distinguishes himself from unbelievers in this regard, he should do it by his high standard of scientific research, by admitting into his work every sound method, and hence avoiding that despicable appearance of slovenliness, occasioned all

too frequently by the fact that after all he is in possession of the truth by the easy way of revelation.

II. The Positive Catholic Ideal in Research and in the Teaching of Science

After this negative clarification it remains to ask whether our research and our science-teaching ought to be simply on a par with that of the modern pagans. We answer this question with a determined and uncompromising NO! Let us divide this constructive part into three subdivisions:

1. The aim in our work of research and teaching is the whole man, the Catholic man;
2. This aim as effected by the sciences must be accomplished by subordination, coordination, and sublimation;
3. A practical instance as regards the theory of evolution.

1. Our Goal Is the Catholic Man

It is quite definite that our way of pursuing scientific research and our methods of teaching must be determined by our whole Catholic outlook upon life. The modern schism—and here the word "schism" is taken in its literal meaning of "a split" or "a severance," meaning that your religion is to stay inside the walls of the church or within the chaste sanctum of your heart, and should not be allowed to exercise any influence upon your whole life—this modern schism is essentially anti-Catholic. According to our Catholic viewpoint, there is only one thing that matters; there is only one thing to which we must subordinate our whole lives, namely, God. We are bound to love the Lord our God with our whole heart, and with our whole soul, and with our whole mind. (*Mat.* 22, 37) The whole! There is nothing with which we should not love our Lord. There is nothing which should not be put into the service of our Lord. Certainly, the sciences are no exception.

Of all human activities of the mind, the search for truth and its transmission by teaching is only one small factor. How is it to be surrendered into the service of the Lord? Let me begin with the wisdom of two great Doctors of the Church.

Before an academic gathering in Paris, Saint Bonaventure delineated the aim of all our science, all our learning. Borrowing from Saint Bernard, he spoke these lines:

> There are those who wish to know only to know: and this is base curiosity.
>
> There are those who learn and wish to know in order to be known: and this is base vanity.
>
> There are those who wish to know in order to vend their knowledge for money or honors: and this is base greed.
>
> There are those who wish to know in order to edify others: and this is charity.
>
> There are those who wish to know in order to be edified: and this is prudence.
>
> Knowledge is puffed up, but charity edifies: then knowledge should be yoked with charity.
>
> (*De Donis Spiritus Sancti,* Coll. IV, 23–24; t.V. p. 478)

One goal, which in essence comprises two aims, is admitted by Saint Bernard and Saint Bonaventure, and that goal is edification in charity. The word "edification" here retains its original forceful meaning, that is found so often in the Epistles of Saint Paul and used by Christ himself. Edification is the *oikodomesis,* the "building a house," namely, a life in Christ. It is the construction of that building whose foundations are laid in Christ and whose crowning is Christ, the Head of all. It is in reality the building up of that house which is Christ living in and realized in every good Christian.

Every science that is being explored or transmitted to others in teaching must contribute to this edification, or the building up of Christ in charity. After all, that is the purpose of our whole education. Our aim cannot be to form a gentleman who happens to be a Catholic and remembers that fact quite regularly on Sundays—but only on Sundays. Our goal must be to build up Catholic personalities who are completely gentlemen because they are Catholics in the fullness of the life of Christ, or rather, let us say, who have the goodness of a gentleman where the norm of goodness is the measure of Christ and not the measure of the world.

2. The Application to the Sciences

It is clear, then, that the sciences too must contribute towards the realization of the goal of Catholic education. The scientist himself, whether engaged in research or teaching, must keep this high aim in

mind, otherwise he works in vain. But he must also realize, especially as regards teaching, that he is not the only one thus to build up and edify, but that he is but one of many craftsmen. If our aim is the Catholic man, that is, the whole man, in whom the supernatural and natural realm is readjusted in a Christian way, then the teacher should integrate his teaching and combine his efforts with that of the others. This will demand certain requirements on behalf of the teacher and his teachings. It seems that we badly need a program of education for educators in the Catholic sense, but we have no intention of enlarging upon this topic. Suffice it to say that the teacher himself should first of all be such a whole man—that is, a Catholic man—and that he at least sees and realizes his task. And he would be the perfect Catholic scientist if he were able to make his science a prayer.

Here we advance a few observations only as regards the task of the teacher. We shall group them around three requirements. His scientific work should be subordinated, coordinated, sublimated. For personal reasons preference will be given to Biology.

a. The scientific work must be subordinated

The sciences cannot inform us about the ultimate end of man and the means to reach it. Christ has taught us these vital truths and entrusted them to the Church. Hence, they are completely above the sphere of the sciences. The sciences have no right, nor are they in a position to shake these truths, to question them or to refute them. If our work in the sciences aims to contribute to the ultimate goal of man, it has to do it in absolute subordination. In an humble acknowledgement of the limits of our sciences must we submit the general results of scientific research to the guiding light of the infallible truth of Revelation, which is invested in the Church and her Magisterium.

This may appear obvious insofar as Catholic institutions are concerned, for they certainly acknowledge it in principle. However, it may turn out to be less obvious in practice. Let us draw a few conclusions:

First of all, it follows that our teaching of the sciences can never equal the value of the teaching of religion. We love a scientist who is deeply interested in his beautiful work and whose ability equals

his interest. But if in practice his enthusiasm descends to the modern worship of the absolute primacy of the sciences, he is not building up, he is not edifying; his work has no place in a Catholic college. The pride of that scientist who indulges in pity for the poor theologians and religion teachers, who are so ignorant, is bound to destroy. This attitude has the peril of being highly contagious. Yet it is this attitude of teachers which will lead, and unfortunately has led, Catholic students into the immediate danger of losing their respect for the one science that teaches us spirit and life.

Secondly, it follows immediately from this that any ridicule levelled against the teaching of religion or of theology in general should be shunned. It is true that theologians have gone too far at times. The Galileo case is but one of these unfortunate incidents which the Holy Ghost has permitted in order to teach theologians a lesson—and the theologians have learned. Though we are firmly convinced that it is useless to try to save the theologians in this particular case from the blame of interfering in matters in which they were not competent, nevertheless, we consider it irresponsible and dangerous on the part of the science teacher to discuss this topic in a sarcastic way and pour caustic comment on theologians, who are, after all, his fellow teachers. Let us never forget that theologians are not the only ones who trespass their domain or who can be proud and vain; in a much more serious manner, scientists have made themselves popes and prophets in fulminating wholesale condemnations.

Thirdly, this subordination should go still further and be not only a silent submission but also a most determined as well as a very discreet loyalty to the Church. There are a number of points where the teaching of the sciences will intersect with the teaching of religion. The Catholic scientist should not blur the issue or anxiously avoid it; he should declare his faithful allegiance to the Church, and finally, try to justify the doctrine of the Church and explain why a Catholic would rather accept this doctrine in preference to the other. Let us give an instance: Sterilization appears quite natural and right to a biologist. The Church condemns it as a eugenic means. The Catholic biologist will state the issue, but will add a justification by pointing out the Church's care for the reverence due to the personality and individual human rights.

b. Scientific work, and especially teaching, must be coordinated.

If we take this subordination seriously, it will have already resulted in a sound coordination of our scientific work with all the other intellectual activities and especially with the teaching of other subjects. Our aim is the whole man, that is, the Catholic man. Mind and character should form an integral unity. Whenever a reasonable occasion is given, every teacher should try to show the connection between our sciences and our whole intellectual culture. Of course, the schedule of our institutions should take care of the coordination in a general way so that we do not produce intellectual *monstra* (in the medieval sense). We want no mere specialists who, though excellent physicists or biologists, are nothing else and who neither know nor appreciate any other or higher values in life. Moreover, the science teacher himself, who is supposed to be an "integral man," should, by his own personality and repeated emphasis on the connection among all our sciences, do his share in forming integral Catholic personalities.

A few hints will suffice to illustrate what is meant:

The science teacher should show himself acquainted with literature and quote from it occasionally. He should show himself acquainted with the ancient languages, at least to be able to explain the numerous technical terms derived largely from Latin and especially from Greek. These explanations admit of interesting digressions. For instance, a botany teacher could impart to his students some of the beautiful legends and point out the wealth of folklore hidden in botanical names. He will find that not only pagan, but also Christian folklore is condensed in some of the technical and popular names. The teacher should draw the attention of his students to this.

The connection of the business department with geography, mathematics, etc., is obvious. Obvious too, is the relation of these disciplines to the arts, painting, sculpture, architecture, and music. But the scientist should not omit to coordinate his classes with that of religion. This is already done when he follows what was said about subordination and will be accomplished to an even greater extent when he follows what will be said about sublimation. A few suggestions here will suffice.

At times, the teacher should bring home to his students the fact

that the study and use of creatures entail also a duty and responsibility for man. It is not true that man has the right to use creatures as he pleases; he has only the right to use them in subordination under God. The problem of vivisection is a case in point. The student should be prevented especially from wantonly destroying nature when collecting specimens. He certainly has the right (if there is no trespassing on property) to take what he reasonably may use for his studies and collections; but he should do that with consideration. He must consider not only that these plants and animals are creatures of God, but that others, too, have the right to enjoy them. Here is a beautiful opportunity for the teacher to engender the sense of responsibility. In regard to our technical achievements the same principles hold. Saint Bonaventure once said that our external activities as kings of nature should be the continuation of the creative activity of God. From this it follows that our technique must be entirely in line with God's designs.

c. Our scientific work in research and teaching must be sublimated.

By this we mean that we are, as Saint Bonaventure puts it, led back by creatures and from creatures to their origin, to the All-Wise, the All-Powerful, and the All-Good God. Do we demand that our lecture halls and laboratories become chapels; that our instructions become sermons? By no means. But if our work does not lead us to something higher than the knowledge of a few creatures—a knowledge that remains fragmentary as long as we leave it at that—then our work is wasted, for it fails to realize the one main task for which all sciences are studied and taught. Is it possible that in a living, integral, Catholic man there are only pigeon-holes for storing knowledge, each of which is separated from the others? Ultimately all our knowledge, obtained with exacting methods and disciplined research, has to become a prayer, a bond uniting us with the First Truth, of Which all creatures are only the words spoken into the emptiness of nothingness when He created them.

It was this deep conviction that inspired Lorinser to write his seven volumes comprising *Das Buch der Natur: Entwurf einer Kosmologischen Theodicee* (The Book of Nature: Sketch of a Cosmological Theodicy). This work was re-edited and brought up

to date by several Catholic scientists in three enormous volumes containing a wealth of beautiful pictures. At the beginning of the work we read the beautiful tract of Hugh of Saint Victor, *De Tribus Diebus,* which is printed in the earlier editions as the seventh book of his *Didascalion.* Should it be so difficult for a scientist, who has an open eye and the mind of Christ and is deeply convinced that every creature is the work of God's power, wisdom, and goodness, to see the reflection of God on the faces and in the very nature of everything? And should he be ashamed to pass on, not in an imposing way but quite naturally, forced as it were by the subject, a few remarks on these reflections which will open up a real understanding of the objects of his science? The scientist who does not do this will remain in ignorance of the book of nature. He may admire the beautiful signs which are spread out before his eyes, he may analyze them into their ultimate elements, but their meaning will never have dawned upon him. He and his students remain illiterate in the worst sense of the word.

3. A Practical Instance

Now let us apply concretely these directives I have just outlined. How can we subordinate, coordinate, and sublimate the theory of evolution?

a. *Subordination*—The Catholic scientist will submit his judgment to the teaching of the Church. Hence he will readily admit, for example, that all things are ultimately created by God; man was created by God; that the human soul, including that of the first by a special act of God; and so on.

For the rest, he is free to admit in the light of the theory of evolution that he thinks is safely established. Since we presuppose that he is both a good Catholic and a man of critical judgment, we expect that he will not blindly believe everything that is being said by ardent adherents of the theory of evolution. We have certainly advanced far enough in our examination of the pertinent data as to propose the theory of evolution as very probable. But we do not know how evolution took place; in particular we do not know the cause of this evolution nor its extent. There is not much evidence in favor of a monophyletic descent of all living things. Darwinism, with its mechanical explanations, cannot give an account of the rise

of entirely new forms nor explain the variety of forms that prevail, since the conditions of environment are by far fewer than the varieties of forms. Modern scientists have mostly adopted the viewpoint of a practical housewife with no sense of beauty. They believe that every form had to have a specific purpose for the vital necessities of an organism. Some of our textbooks are deeply impregnated with this utilitarian reasoning.

Hence, the Catholic scientist, besides being critical, will also be just. He will abstain from criticizing the theologians in general for being ignorant. There can be no doubt that certain theologians went too far in their rejection of this theory. *Sutor, ne ultra crepidam* applies also to the theologian. Yet, the Catholic scientist has no cause to feel resentment against his brethren. He should try to understand them. After all, evolution was advanced and propagated mostly by materialistic, atheistic scientists and is being propagated by Communism. The situation demanded a great amount of reserve. The reluctant attitude of the theologians certainly benefited the theory by preventing it from becoming a blindly-held dogma.

If the Catholic teacher will give his students this reasonable and good-will explanation, he will prevent the student from absorbing the wrong impression, namely, that the theory of evolution has finally triumphed despite the stupidity of the theologians and the credulity of all those who believe in creation. When the teacher explains in this sober and really Catholic way, his students become immune in any attack from outside regarding this particular theory.

b. *Coordination*—In the same way the science teacher in a truly Catholic manner coordinates his classes and teachings with the teaching of religion. He will help the religion teacher instead of causing him trouble. It is not difficult to coordinate his discussions on the theory of evolution with other disciplines. Evolution and development are terms which have applications to many phenomena outside the realm of biology. For instance, we know of evolution or development in civilization, in the life of a nation, of ideas, of art, in language, in the growth of human beings, etc. Furthermore, there is an opportunity to analyze the meanings of these terms and come to a more philosophical treatment of the evolutionary theory itself. The theory of evolution contains many a thorny problem. Does

evolution mean that something more perfect comes from something less perfect? Is a horse more perfect than an amoeba? Is evolution a continuous process or not? If so, how can we account for that? Furthermore, the teacher should also be able to discuss the value of any scientific theory and should know his science so well that he knows that even modern scientists do not claim more than a high degree of probability for their theories.

c. *Sublimation*—The theory of evolution is intimately connected with the problem of the species and their almost unbelievable multitude. We know by faith that this prodigious abundance and wealth goes ultimately back to the Creator of heaven and earth. Why all these forms? Evolution can explain them only in part. There are many forms which do not constitute a value or an advantage in the struggle of life; they are useless in this sense, and for that reason they are beautiful. Beauty is a factor that is not necessitated by lower needs, but is something that supposes the liberty of artistic creation. If we look at all these forms and their beauty, will we not be led back to that first Artist, the wisdom of the Creator, of which we read in the Epistle for the Feast of the Immaculate Conception, "Ludens in orbe terrarum." This Artist, God Himself, has spread out before our eyes this mighty piece of art, the result of His divine play. But it is not only a static picture. All these various forms have their history. It seems that according to recent discoveries, especially in palaeontology, evolution has taken place not in a continuous line but in series of jumps. It seems that first a new form takes its tentative appearance, then suddenly it bursts forth in a great variation of new forms; then these forms show a more restricted development, and finally a degeneration of forms takes place and a few survive. Here again, we are watching the great Artist of the Universe, the Wisdom of God, *ludens in orbe terrarum.* But now in a dynamic piece of art, in a real play. Saint Augustine first conceived of history as the *pulcherrimum carmen,* and Saint Bonaventure repeated it. Here too, we enjoy in evolution with its various periods, its acts and scenes, and individual actors, a *pulcherrimum carmen,* which has been played by the divine Wisdom since the first organisms were called into existence, and of which our present forms are but one scene.

Let us close with Saint Bonaventure: "And this is the fruit of all sciences, that in all faith be built up (edified), God be honored, the moral life be ordered and consolations be drawn from the union of the spouse with her beloved: this union takes place through charity, to the attainment of which the whole purpose of Sacred Scripture, and, consequently, every illumination descending from above, is directed, and without which all knowledge is in vain."

DISCUSSION

CELESTINE O'CALLAGHAN, O.F.M.:—1. Fr. Philotheus wrote, "The Catholic scientists . . must go over to the offensive, take away from the enemy the weapon used for destruction, and employ this method for construction. He must do the same as the Fathers of the Church did with Greek speculation; the same as the great Scholastics did with the onrushing Greco-Arabian philosophy and science in the thirteenth century."

"The Fathers and the Scholastics were able to do these things in the first place because they had a professional knowledge of Greek speculation and Greco-Arabian philosophy and science. The charge is rightly made against the scientist turned philosopher that he is often only a dabbler in philosophy. A similar charge can be leveled at the philosopher turned scientist who is not competent in the field of natural science. That is why I think Fr. Philotheus should be a model for us all. He was a professional biologist and a professional philosopher.

Some of the philosophical problems of modern science are phantom problems. The postulates of Euclid were at one time looked upon generally as absolute truths. The rise of the non-Euclidean geometries has led some to say that therefore the laws of mathematics are as completely arbitrary as the rules of chess. An examination of both types of geometry shows that the Euclidean and non-Euclidean postulates are mental constructs founded on our experience and are neither absolute truths nor completely arbitrary statements.

2. Fr. Philotheus wrote that we should not expect science to support every medieval philosophical notion. It is true, on the other hand, that the common teaching of Scholastic philosophy is of tremendous value in studying the nature of physical theory. I was much confused and dissatisfied with the explanations of the scientists themselves. I found Father Renoirte's Cosmology—Part Two —The Elements of a Critique of the Sciences—very, very helpful in this connection.

3. There are places in mathematics and physics where philosophical questions can be introduced in a meaningful context. Newton's Laws suggest questions on the meaning of definition, postulate and law. The importance of mathematical equations in physics leads to a discussion of "function" in the mathematical sense. Here it is possible to point out that "cause" as used in physics and biology is in the spirit of Mill's definition. When I have done this I have found the students extremely interested. Rather than answer the questions for them I have suggested they read Renoirte. I am happy to say a high percentage have done so.

Every teacher is asked, "Of what practical value is this?" We should not be shocked and abandon the student as a hopeless materialist. Even when there is a practical application I sometimes go through the first chapter of *Genesis* stressing the sentence which appears at the end of each creation—"God saw that it was good." We do not study science merely to refute the arguments of non-Catholic scientists. We study the physical world from many aspects because it is the work of God's hands and good and worthy of man. Again, the students have liked this idea.

THE NATURAL SCIENCES IN THE ITINERARIUM OF ST. BONAVENTURE

Sebastian F. Soklic, T.O.R.

Introduction

"What is man, that Thou art mindful of him, or the son of man, that Thou are concerned about him?" (*Ps.*, 8/5) Isolate the first three words of the much quoted verse and we have the birth of a living question, namely: "What is man?" Set apart the three words from the remaining context and they stand alone. And standing alone we destroy the possibility of ever discovering their true significance—and completely diminish the hope of ever answering the question adequately. And, if the hope of an answer is not to be found then man verily *stands alone.* But, if man's nature is doomed to a meaningless existence *alone,* he will function listlessly in a world of frustration—searching for the unreachable.

When the psalmist adds: "That Thou art mindful of him etc." he immediately implies a solicitous providence. Solicitous providence implies love and affection. Love tends towards union with the object of affection. But union with the loved one is contradictory to *aloneness.* Hence, man's nature, with its various desires, was never destined to be alone; but to be placed within the realm of hope in which someday it will culminate in a union with the Image and Likeness Who created it, there to enjoy eternal bliss and peace.

On the face of it, this question appears to be such a simple one, requiring a simple answer. This is true. Yet a cursory glance at the history of human or philosophical inquiry indicates that in all the conflicts between the different philosophical schools this living question: "What is Man?" is the fixed and immovable center of all thought.

This conflict then, has roughly divided mankind into two groups. One admits the existence of the supernatural, the other ignores or denies it, and the men in each group, of course, think and act

accordingly, the way they think and the way they act will affect every phase of human development.

The result of which causes Max Scheler to say:

> In no other period of human knowledge has man ever become more problematic to himself than in our own days. We have a scientific, a philosophical, and a theological anthropology that know nothing of each other. Therefore we no longer possess any clear and consistent idea of man. The ever-growing multiplicity of the practical sciences that are engaged in the study of men has much more confused and obscured than elucidated our concept of man.[1]

Modern philosophy then finds itself in a very strange situation. No former age was ever in such a favorable position with regard to the sources of our technical and scientific knowledge of human nature. When compared with our own abundance the past may seem very poor. But our wealth of facts is not necessarily a wealth of thoughts.

Unless we succeed in finding the right key which will open the philosophical and theological gates wherein dwells the answer to "What is man?" we shall remain lost in a mass of disconnected and disintegrated data which can only lead to intellectual confusion and spiritual ruin.

St. Bonaventure, philosopher and theologian in his *Itinerarium,* does not set the world on fire with a new theory on man and his nature—but has bequeathed to posterity a guide book, a ray of hope for the "high intellectual" who is sincerely searching for truth and true peace. For he must also, at the last, face himself and ask himself: "What am I?" And the longer this crisis lasts the more clearly will these alternatives face him. There is no way to "combine the best features of both sides of the controversy." It is one or the other.

Emerging from St. Bonaventure's towering intellect and humble heart is the soothing, strengthening ointment which will heal the intellectual malignancies, if men but realize that the higher we build our intellectual structures the more deeply must we root them in the simple answer—that man is a creature of God, "noble in his origin, noble in his earthly existence, and noble in his eternal destiny."

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[1] E. Cassirer, *An Essay on Man* (New Haven: Yale University Press, 1944), p. 22.

Historical Observations

In the Middle Ages as in any age, as time bears witness, thoughtful men craved a scheme of life complete even in detail. It had to be satisfying and complete. The entire view was, then, a united and amalgamated scheme of salvation. But a scheme of salvation is a chain, which can hold only in virtue of its completeness; break one link, and it snaps; leave one rivet loose, and it may also snap. A scheme of salvation must answer every problem put to it; a single unanswered problem may imperil it. In seeking an explanation of the phenomena of the universe without, the human mind seeks a unity of explanation, which, in turn, requires a completeness in the mental scheme of what is to be explained. This was the achievement of the Schoolmen—a complete and final statement of the nature of God as far as that might be known, of the creature world, corporeal and incorporeal, and especially of man, his nature, his qualities, his relationship to God and his final destiny.

St. Bonaventure's Dilemma

In St. Bonaventure was to be realized the extraordinary, fertile paradox of a genuinely Franciscan soul seeking its inner equilibrium in learning, and constructing its philosophy of the universe under the pressure of its own needs. What St. Francis had simply felt and lived, St. Bonaventure was to think; the personal intuitions of St. Francis were totally detached from science, but they were to work like leaven in the mass of philosophical ideas piled up by Bonaventure in the University of Paris.

St. Francis' influence upon Bonaventure had not been only moral: it had in fact penetrated to the very depths of his intellect. It was St. Francis who taught the Doctor of the University of Paris, with all his learning, the lesson of total adherence to God by the savour of contemplation which Bonaventure was to make the directive principle of his whole doctrine.

St. Bonaventure was not the man to forget these lessons and we may say that his whole philosophy is conditioned by the experience of Franciscan spirituality.[2] Indeed he has affirmed this himself in

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[2] Consult on this point Smeets, art. "St. Bonaventure," *pict. de theol. Cathol.*

the most explicit manner at the beginning and end of the work which contains the totality of his profound intuitions, the *Itinerarium Mentis in Deum.*

But, for all the efforts he made, St. Bonaventure could not force himself to follow to the end the way of the humble. He could bear patiently the lesson of Blessed Giles [3] and repeat with him that a poor old woman, ignorant and simple, could love God better than Brother Bonaventure, but for all that, he could love God in his own way and that way was the way of the learned. All happened as though ecstasy, conceded gratuitously by God to the perfection of certain simple souls, had remained for the illustrious Doctor an ideal only to be reached by the long and winding paths of learning.

For imitation of St. Francis could not be literal imitation as he had to omit the extraordinary asceticism and the extreme macerations practiced by him: it had to be rather a translation. And this translation itself was possible only if some other discipline would come to fill the void, and play the part played in the earlier saint by discipline of the body. And, extraordinary as the thing must have seemed, why should this new discipline not have been a discipline of the mind?

Prayer and meditation already had been so wonderfully practised by St. Francis. But why not also a new transmutation of learning into love, a transmutation unknown to the founder of the Order because the ways of learning had not been his?

The Present Conformity

The fact is that many friars, even during the lifetime of the Founder and during the first decades after his death when the memory of his life was strongest, threw themselves with the greatest zeal into the pursuit of knowledge and, at the same time, enjoyed among the friars the reputation of being the best Franciscans. That is true, for example, of the provinces of Bologna and of England in the thirteenth century.[4] Those friars certainly did not believe that

t. II, col. 977–978; also P. Ephrem Longpre, "La Theologie mystique de Saint Bonaventure," *Archivum Franciscanum Historicum,* t. XIV (1921), pp. 36–108.

[3] *Ibid.,* "Chronica XXIV Generalis," t. III, p. 78.

[4] *Archivum Franciscanum,* I, 228, 244, 254; IV, 5, 24.

they were working contrary to the wishes of St. Francis, with whom they stood in immediate connection by a living tradition. Here also must be quoted the beautiful words of St. Bonaventure:

> I confess before God that this is which made me most love the life of St. Francis, namely that it is similar both to the beginning and the perfection of the Church, which began, indeed, with simple fishermen and later advances to most learned and skillful doctors. The same you will see in the Order of the Blessed Francis.[5]

Now in the year 1955, all studies are permitted to the Franciscan only in so far as they manifest the spirit of St. Francis and are in accordance with the purpose of the Order. This purpose insists that truth can be had only by the constant, persistent labor of the human mind making an objective trek into the world of reality. Only then can the intellect hope to penetrate into the heart of things that are proposed to it (understanding), acquire an accurate judgment about creatures (knowledge), and avoid making mistakes about the common end of life by synthesizing everything in the light of the universal cause (wisdom).

The Integrated Religious Personality From the Viewpoint of Knowledge

To St. Bonaventure there could be no total separation between philosophy and theology. They are not on different levels, estranged from one another, for philosophy alone leads man's mind to confusion, and theology without reason leads to fanaticism.

The golden thread which ran through the entire tapestry of Medieval thought was the fixed attention on the final problems of life of which religion must take account. Hence, philosophy became the handmaid of revelation and it helped to satisfy the natural curiosity of the human mind concerning the "how" of natural questions that man found difficult to answer. But the unifying and integrating force of knowledge, flowing from the various sciences received its strength and beauty from the conviction that the human mind, or personality, could *see* the answers only because they originated from the "Father of lights." Indeed, by its nature it tended to produce a well-integrated religious personality.

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[5] St. Bonaventure, *op. cit.*, t. 8, 336.

Our First Step Into the Itinerarium

When we open the *Itinerarium,* we discover a Bonaventure who is wholly a Franciscan, a Bonaventure who has learned from St. Francis not only a few rules, or even a rule of life, but also a whole new outlook on life, a whole new ideal.

But even in the *Itinerarium,* which is truly Franciscan, one will notice the absence of simplicity of St. Francis. Therefore, it will be necessary to remember that it is the Master of Paris who is speaking to us, and that he has not *unlearned* his philosophical and theological wisdom and language, of which he had such a masterful command. But to counter-balance this, one should remember, too, that it is also the great Master of Paris who could not find satisfaction and peace in the great lecture halls of Mt. Genevieve but humbly climbed the mount of Alverna in the footsteps of his holy Father, and learned there the secret of peace as St. Francis understood it—a peace that is the perfection of wisdom.

It is best to let St. Bonaventure tell us how he came to compose it.

> Inspired by the example of our blessed Father Francis, I sought after this peace—I, a sinner, who, though in all respects unworthy, have succeeded him as the seventh head of the Order. It happened thirty-three years [6] after the death of our glorious Founder, about the time of his passing-over, that I, under the urgings of divine impulse withdrew to Mount Alverna as to a place of quiet, there to satisfy the yearning of my soul for peace. While I abode there, pondering on certain spiritual ascents to God, among other things, I was struck by the miracle which in this very place had happened to the blessed Francis—the vision he received of the winged Seraph in the form of the Crucified. As I reflected on this marvel, it soon came to me that this vision typified the uplifting of our Father in contemplation of prayer and that it pointed out the manner of reaching that state of contemplation.[7]

Now the Seraphic Doctor, St. Bonaventure, follows as it were in his Itinerarium, the model of his master and father in religion. What St. Francis simply lived, the Seraphic Doctor transforms into thought and ideas, analyzing, and clarifying them, and composing them into a system and method which is, in fact, the *Itinerarium* of

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[6] I.e., 1259, since St. Francis died Oct. 4, 1226.

[7] *Itinerarium Mentis in Deum,* Prologus, n. 2, p. 290 (Editio minor.). Note: All further references to the *Itinerarium* will be indicated thus: (I. 1) meaning Chapter I, number 1. The editio minor (Quaracchi) will be the text.

the soul to God. I do not mean to say, however, that St. Bonaventure only transformed the experiences and visions of St. Francis into philosophical and theological language and nothing more. For St. Bonaventure is less and is more than St. Francis. He is certainly less as regards originality and immediacy of life, in which Francis is unsurpassed. He is more because of all his learning in philosophy and theology. But, and this matters here, he has caught in his own way the spirit of St. Francis, the meaning of his life and his ideal and has formulated it in the language of a philosopher and theologian. The result is the *Itinerarium*—the pilgrimage of the soul to God, or rather a plan of the pilgrimage, which the soul of an intellectual Franciscan can follow in order to reach the high goal of St. Francis: namely, peace and rest in the foretaste of things to come in mystical experience.

Hence, I conclude, somehow repeating, that the *Itinerarium* is essentially a Franciscan tract in which St. Bonaventure outlines for men of learning an *itinerary*. Followed in the spirit of St. Francis it will help them to reach, in some degree, the contemplative life that St. Francis himself reached.

We are now in a condition to understand the plan of the *Itinerarium*. The prologue and the introduction to the first chapter serve only to prepare the mind for the ascent that it is about to make. The last chapter leads the mind to the goal itself, namely, to peace in Christ Crucified, to the Mystical union. The six intervening chapters describe the ascent itself. This ascent starts with things that are outside the mind, passes through things that are within the mind and then transcends these to go to the things that are beyond the mind. In none of these steps is any special revelation required. Everything that faith and reason, theology and philosophy, can teach us is used to build up a ladder from the lowest creatures to the highest ideas, by means of which the mind finally will plunge into the joy of the Blessed Francis through Christ Crucified.

Natural Sciences

Since all things are made according to their pattern in the divine ideas, all things bear the seal of their divine descent: all things are analogies of God. "Omnes creaturae effantur Deum. Quid ego

faciam? Cantabo cum omnibus." [8] "Quia per creaturas ad cognoscendum Creatorem venimus, et ut plurimum, fere omnes creaturae habent proprietates nobiles quae sunt ratio intelligendi Deum." [9] There is in St. Bonaventure, then, a positive evaluation of all creation that finds the reflection of God everywhere. Hence, the Franciscan School stresses more the positive meaning, the likeness of all things to God. With this consideration we now branch off into the various phases of human and intellectual strivings according to St. Bonaventure's *Itinerarium.*

We are living in an age that is molded and guided by the sciences. The sciences have become a world-power of the first order. Under their influence and dominion a new world has been shaped; a new outlook on life is in vogue; mighty revolutions and ideologies have been conceived under their influence and inspiration. In short, the sciences have become a factor in culture and civilization, in religion and philosophy, and in this atomic age the main factor in politics.

Are we to conclude then that the study of sciences is a danger or threat to the development of a well-integrated religious personality? Quite the contrary. We need only to open the *Itinerarium* and read how St. Bonaventure "baptized" the sciences, to make them an instrument for a higher goal. And so, we read:

> The steps in the ascent to God and how we can see God through traces of Him in the Universe. In this vale of tears, this seeking is done by sighing for divine aid in fervent prayer. Prayer, then, is the mother and origin of every onward striving (suspension) of the soul. (I, 1 p. 294.)

By so praying, we are given light to discern the steps of the soul's ascent to God. For we are so created that the material universe itself is a ladder ascending upwards to God. And among things some are traces, some are images; some are corporeal, some are spiritual; some are temporal and some everlasting. Hence, some things are outside us and some within us. In order to perceive the First Principle, which is wholly spiritual and eternal and above us, we must pass through the traces which are corporeal and temporal and outside us. *Thus we are guided in the way of God.* Next we must enter into our minds which are images of God, images that are ever-

[8] *In Hexaem.* XVIII, n. 25, (t. 5, 418).
[9] *Ibid.,* 1, 594.

lasting and spiritual and within us. And likewise we enter into the truth of God. Finally looking at the First Principle we must go beyond to the eternal, the absolutely spiritual, that which is above us. Thus we rejoice in God by a knowledge and reverent fear of His Majesty. (I, 2, p. 295.)

In keeping with this three-fold progression, our soul has three principal ways of seeing. In the first way it looks at corporeal things outside of itself: and so acting, the soul is called animality or sensitivity. In the second way the soul looks at itself and to itself, and so acting the soul is called spirit. In the third way the soul looks above itself, and so acting the soul is properly named the soul. (I, 4, p. 296.)

Therefore, the soul rises from visible things to the consideration of the power, wisdom, and goodness of God, insofar as He is existing, living, intelligent, purely spiritual, and immutable. (I, 13, p. 300.)

According to St. Bonaventure, there is only one thing that matters: there is only one thing to which we must subordinate our whole lives, namely, God. We are bound to love the Lord our God with our whole heart and with our whole soul, and with our whole mind. (*Matt.*, 22, 37.) The whole! There is nothing with which we should not love our Lord. There is nothing which should not be put into the service of our Lord. Certainly the sciences are no exception.

> We should employ all these ways in order to ascend to God, so that we may love Him *with whole mind—whole heart* and *whole soul.* Herein lies the perfect observance of the Law, simultaneously, of Christian Wisdom. (I, 4, p. 296.)

Once, before an academic gathering in Paris, St. Bonaventure spoke about the aim of our sciences. He repeated the words of St. Bernard:

> There are those who wish to know only to know: and this is base curiosity.
>
> There are those who learn and wish to know in order to be known: and this is base vanity.
>
> There are those who wish to know in order to vend their knowledge for money and honors: and this is base greed.
>
> There are those who wish to know in order to edify others: and this is charity.

> There are those who wish to know in order to be edified: and this is prudence.
>
> Knowledge is puffed up, but charity edifies: then knowledge should be yoked with charity.[10]

One goal, which in essence comprises two aims, is admitted by St. Bernard and St. Bonaventure and that goal is edification in charity. The word "edification" here retains its old strong meaning, its original meaning which we find so often in the Epistles of St. Paul and which was used by Christ Himself. Edification is the "oikodomesis," the building of the religious house, the life of Christ. It is the building of that house whose foundations are laid in Christ and whose crowning is Christ, the Head of all. It is in reality the building up of that house which is Christ living in and realized in every good Christian. Every science that is being explored or transmitted to others in teaching must contribute to this edification, or building up of Christ in charity.

In regard to our technical achievements the same principles hold. St. Bonaventure once said that our external activities as kings of nature should be the continuation of the creative activity of God.

> The observer considers things in themselves and sees in them weight, (or gravity), number, and measure: weight, respective to the place towards which things incline, number by which things are discerned, and measure by which things are determined. Consequently he sees things in mode, species, and order, as well as in substance, power, and activity. From all these considerations the observer can rise, as from the consideration of a trace to a knowledge of the wisdom of the Creator. (I, 11, pp. 299–300.)

By this St. Bonaventure says we are led back by creatures and from creatures to their origin, to the All-Wise, the All-Powerful, and the All-Good God. Ultimately all our knowledge, obtained with exacting methods and disciplined research, has to become a prayer, a bond uniting us with the First Truth, of which all creatures are only the words spoken into the emptiness of nothingness when He created them. We must be penetrated by the deep conviction and ever-present idea that we are dealing with creatures which reflect God's power, wisdom, and goodness.

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[10] *De Donis Sp. S.*, coll. IV, 23–24 (t. 5, 478).

> Therefore he who is not enlightened by such great splendor in created things is blind. He who remains unheedful of such great outcries is deaf. He who does not praise God in all these effects is dumb. He who does not turn to the First Principle after so many signs is a fool. Open your eyes, therefore, alert the ears of your spirit; loosen your lips and apply your heart that you may see, hear, praise, love, and adore, glorify, and honor your God in every creature, lest perchance the whole world shall fight with him against the unwise. But on the contrary it will be a matter of glory for the wise, who according to the prophet can say: For thou has given me, O Lord a delight in thy doings, and in the work of thy hands I shall rejoice. How great are thy works, O Lord! Thou has made all things in wisdom, the earth is filled with thy riches. (I, 15, pp. 302–303.)

Conclusion

Continuing with St. Bonaventure's spirit we can further say that man was created to know and love his God. Obviously there can be no other norm of human living than the knowing and loving of that God. He must turn from creatures back to God and although handicapped at first by injured and deformed faculties of knowing and loving, he must remember that the very direction of them towards God will be their cure.

Like a homesick Prodigal Son, man must come home to God. His whole life must be a journey back to his Father's house—a journey back to the rectitude of Paradise.

The end of the Franciscan Order is spiritual, the principal element in an educational scheme to promote that end must likewise be spiritual. With the Franciscan then, neither philosophy nor theology can be regarded as being anything but a means to an end.

The *Itinerarium* is a Bonaventurian argument which apologizes for the study of all sciences, philosophy included, on the ground that they practically fit the subject for the preaching of the Gospel of Christ. If then, Franciscan philosophy is to be worthy of its name, it must be an edifying science, i.e., it too must lead to the ultimate end of the human being. This requirement of Franciscan philosophy in no way contradicts the others, namely, that it be critical, scientific, and progressive.

For the function of philosophy, as St. Bonaventure puts it in his *Breviloquium*, is to lead man to God through all the ascending series of creation. But the God of Franciscan philosophy is Jesus Christ. He alone imparts full and final intelligibility to the general trend of the world's course, and to that ever aspiring, though sagging,

life-process which appears in human thought and human love. Anchored to this conviction then, the Franciscan may deal with any problem whatsoever, as long as he does so in the spirit of St. Francis, who saw and loved God in every creature, and found in every honest human activity a ladder to God.

And so, in this paper we have followed St. Bonaventure's philosophic thought to its goal: and as we arrived at the promised end it looks as though we have not so much travelled in a straight line as circled round a center. Our essential task has been to determine exactly the point where that center is, and there take our stand.

Philosophy has not for its end to teach us to determine the center of things, as we determine the center of a circle by showing the lines which pass through it; its end is rather to assure us the possession of this center by conferring upon us the habit of mind whereby we turn towards it inevitably no matter what the point at which we find ourselves, and the aptitude to relate any other point to the center once we have established our mind in it.

I indicated above that the God of Franciscan philosophy is Jesus Christ, hence Jesus Christ is the center of thought. "Circa secundum noto, quod incipiendum est a medio, quod est *Christus*." [11] Beginning with Christ as the center we shall immediately find that we can enter into the right relation with everything, starting from Him; and likewise, if we start from any other thing we shall be brought back to Him. As the heart is the center of the microcosm, the source from which the life-giving blood courses through the veins and arteries; as the sun is the center of the macrocosm, the source of life and heat in the material world; so has the Word become the center of heaven and earth by taking flesh and dwelling among us.

He is the Mediator by Whom the soul is united to God in this life; [12] He is the truth by which we arrive at Christian wisdom, for in Him are contained all the treasures of wisdom and knowledge.

In the *Itinerarium* St. Bonaventure has found the answer to the third problem of his metaphysics, the return to God by Divine illumination. All along the luminous path, in all nature, in all science, he has discovered traces of Divine Wisdom, hidden footprints, images, and likenesses of the Blessed Trinity which lead the soul of man back to its First Cause and its last end. In thus re-

[11] *In Hexaem.*, I. 10, t. V., p. 330.

[12] "Ipse enim mediator Dei et Hominum est." *Ibid.*, I, 10, t. V., p. 330.

constructing every science and the whole universe with a view to the true peace of the love of God, St. Bonaventure has attained the purpose and end of all knowledge namely:

> Thus it is that no matter how enlightened one may be by the light coming from nature and from acquired knowledge, he cannot enter into himself to delight in the Lord, except through the mediation of Christ Who says: "I am the door. By me, if any enter he shall be safe: and he shall go in and go out and shall find pastures." (IV, 2.)

This, then, was the Medieval solution. Has any better been found?

DISCUSSION

JUNIPER CUMMINGS, O.F.M.CONV.:—It seems to me that there is a missing or rather neglected link between St. Francis and his interpreter, St. Bonaventure. Fr. Sebastian pointed out the Christocentrism of St. Bonaventure. Fr. Bonnefoy has assembled texts concerning just this point of Christocentrism, which indicate even a verbal influence of Anthony on Saint Bonaventure. Even if we don't grant such an influence, they did both speak in the same words and spirit and used the spiritual source if not the same literary source.

Fr. Thomas referred to St. Bonaventure's use of Scripture, once again the first teacher of the Order, St. Anthony led the way. St. Anthony in his *Sermones* quotes Scriptures some 5,000 times. The Locatelli edition of the same covers only about 900 pages. It is said that St. Anthony could have reconstructed the entire Scriptures by heart had they been lost. St. Anthony also used numbers and symbols very effectively. It seems to me that St. Anthony is still much neglected by us Franciscans. It is certainly true, as Fr. Plassmann said so beautifully, "Bonaventure set the foundation, Scotus built it to the sky" but I think we could add Anthony dug the foundation.

GOD THROUGH NATURE

Reinhold Link, O.F.M.

The words "God through Nature" are a direct quotation from the late Pope Pius XI's reminiscences of his mountain climbing days. They are used here as a title to a course in nature study. Whether for young or old, the teacher or taught, nature can be interesting or, more than that, fascinating, according to its presentation. Certainly a preliminary survey of the out-of-doors, an introductory exploration of fields and woods and waters is an adventure and offers deep satisfaction when there is opportunity to grasp what classifying and identifying can mean, what insights are offered into the ways of the little and big of nature. Then add to this that to the clean of heart and right of mind such a pursuit ends up inevitably in seeing God—what a thrill in the discovery, how much the heart wells up with gratitude at God's tremendous goodness. It compels a person to go forth and tell all creatures of His wonderful ways.

It is true, of course, that not all can make of this a life or a vocation. It may even be that the young especially will have to be appealed to at first in some such unsentimental and practical way, as an article in the February 19, 1954, issue of *The Bennet* entitled "Benefits of Biology" presents. It begins: "In answer to student objections, such as 'What good will biology ever do me? I'm never going to be a doctor,' Father Raphael states that there are over 2000 kinds of work which require some knowledge of biology for successful performance. Biology helps to give a student a clearer, fuller picture of his relation to the world about him. It assists him to develop a more reasonable and intelligent outlook on life. It will broaden and deepen the student's interest in God's handiwork. Socrates said, 'Know thyself.' Biology helps a student to do just that."

Studying Nature

In this country at least it is not usual that this study is enjoined on the young. It must be a matter of regret that such a condition of

affairs is allowed to exist. A great educator once said that he considered American education and culture—and the Central Verein concurred in his statement—not to be the equal of the European. The fault lay, he felt, in this very area of discussion; namely, that we allowed our children to graduate from high school and college without a knowledge of the common things around them. "They kick the rocks out of their paths and know nothing of the marvellous history and antiquity they carry. They do not distinguish the sounds of nature, they cannot tell apart their age-old companions the trees, or the flowers, or the birds, or any of the multitudinous life about them. Europe has gained by that very much in higher *tonicity* of culture."

Then there is T. H. Huxley's animadversion: "To a person uninstructed in natural history a country stroll is a walk through a gallery filled with wonderful works of art, nine-tenths of which have their faces turned to the wall." And what are these works? "Thy works are not as other works," wrote Thomas DeQuincey, "simply and merely great works of art; but they are also like the phenomena of nature, like the sun and the sea, the stars and the flowers; like frost and snow, hail and storm, rain and thunder, which are to be studied with entire submission of our own faculties, and in the perfect faith that in them there can be not too much or too little, nothing inert or useless—but that the further we press in our discoveries, the more we shall see proofs of design and self-supporting arrangement, where the careless eye had seen nothing but accident!"

Still another quotation, (from an eminently wise statement of that Cambridge University publication entitled "On Education," authored by Sir Richard Livingston) fits in here in natural sequence on the statements made above. This is what it says: "Education entails *spiritual* training in terms of the best that has been done, thought and written. The most indispensable viaticum for the journey of life is a store of adequate ideals, and these are acquired in a very simple way by living with the best things in the world—the best pictures, the best music, the best books, the best buildings, the best social or political orders . . . the best human beings."

And if one cannot perceive all along in this article the application to Jesus Christ, the Son of God, in a way pre-eminently supreme, then he must be rationalistic indeed or unreceptive. But he can also

see in hundreds of ways how God's pictures in nature, being best of all, are eminently worthy of man's study—"The pictures are not up for judgment, Sir!" said the indignant Ruskin. "You are!" He can see that the chorus of birds, the primitive orchestration of those threshold angels the frogs and the insects, and that mysterious "music of the spheres" itself, as Plato thinks of it, is music unsurpassed. "I am waylaid by Beauty," says Edna St. Vincent Millay of the singing of the frogs. From Vachel Lindsay comes this, a paragraph entitled "It is a Time to Think of Small Things:" "To walk through city streets with a deliberate unawareness of the clangor of the moment, listening for those small, sweet sounds that are forever—the rush or whisper of the clean wind, the little silence of dry leaves as they whisk along the street, the tiny calls of sooty sparrows. It is a time, if by hook or crook we can manage it, to quit the city wholly for a little while—for an hour, for a day—and to walk in a meadow or climb a hill, or just sit on a fence-rail." Cries Lindbergh, "How long can men thrive between walls of brick, walking on asphalt pavements, breathing the fumes of coal and of oil, growing, working, dying, with hardly a thought of wind, and sky, and fields of grain, seeing only *machine-made* beauty, the mineral-like quality of life?"

Now, on the other hand, none of us dare remain a mere hobbyist in nature, even though we cannot make a life study of it. To hug all this selfishly to one's shallow self, instead of going out to the God Who made all this, is to cheat Him and ourselves. The noted psychologist, Dom Verner Moore, O.S.B., speaking to teachers, asked searchingly, "*Must every course* be in some way hammered into shape so that a direct reference to God will appear as part of the matter of instruction? Or should the teacher rely more upon his spiritual perfection, his own love of God and the students who come to him, to work silently like the leaven in three measures of meal until the whole is leavened?" He went on to this answer: "It seems to me that this latter is the more important method, but it is a holy and wholesome thing for any teacher to find in his matter of instruction something that refers to God and so lift the minds of his students from the things of earth to those of heaven. . . ." No class is successful in which the professor does not at least once cause the students to hold their breath in rapture or enthusiasm.

So Robert Browning could trumpet his, "This world's no blot for us, nor blank; It means intensely and it means good—To seek its meaning is my meat and drink." St. Augustine was clearer: "The purest happiness of this earth I think is to think the thoughts that God thought when He created this world." Still more apt from our point of view on a training course called "God through Nature" are the telling words of Cardinal Newman in his *Idea of a University*. They have the impact of a text. We put them in the form of a motto: "God has stamped Himself on His Creation so remarkably that it is impossible to study any part of nature without at the same time studying God."

Even the atheist (though he does not know it, and though he may even repudiate the very thought) cannot help admiring God whenever he turns his eyes to some moving prospect of this earth. It may also be added with reverence that the fisherman and hunter are missing a salutary bet when they do not grasp this reality as they watch so lovingly the wary, innocent, utterly charming ways of wild things around them.

In getting back again to our course, let us now say that we should begin by looking at the *field* of nature itself, its extent, its scope. It includes all in the universe that is not man-made. So we see creation as a kind of three-ringed circus reflecting jovially—if only in shadow—the Trinity itself in a remarkable series of Three-in-One-nesses which the world is constantly bringing to our attention through the mineral, vegetable and animal kingdoms.

Scheduled Program

The days devoted to this unique study of the universe must have a habitation and a scheduled program. We boldly follow Lois Agassiz' famous dictum, "Study Nature, not books!" though we do not forget that he ironically had the most splendid collection of books on natural science in the world in his day. It does seem surely sensible to get right out into the middle of nature for such work, and stay there. Ideally, too, if we follow St. Teresa of Avila, we will select a site as uplifting as this mundane world can afford. If we can exclaim about it as Newman did near Taormina, then truly we are beginning right. He wrote back home: "Here it is easy to become a saint!"

Then as to each day's program. Each day is devoted to a leading subject, rocks or trees or birds, whatever it may be. Each day is fairly organized usually as follows. First comes the acknowledgment of God formally in Mass, less formally in various forms of meditation, which often may take the guise of a stroll according to Father Duffy's aphorism, "Walking is conducive to meditation." That thoroughly Protestant, Thoreau, put it more beautifully still: "I have met with but one or two persons in the course of my life who understood the art of walking . . . who had a genius so to speak for sauntering (sainting), which word is beautifully derived from 'people who roved about the Holy Land.' "

Indeed it is true that full many a God-colloquy arises spontaneously out of the glories around us. St. Teresa could write that she prayed best in a garden. St. Bonaventure, a saint himself, could write of St. Francis: "He beheld in fair things Him Who is most fair, and through the traces of Himself imprinted on His creatures, followed to reach the Beloved," and Theodore Maynard adds: "To Francis the whole world shone and twinkled with the glory of God, and the keener Francis's sense of that glory became, the more he loved the visible world which was the Home God has made for men before taking him to his eternal home in heaven." "His was the poetry of innocent wonder, a beauty seen through the wide, candid eyes of a child. As Chesterton finely expresses it, "water itself was now washed, fire itself purified as by fire."

If Mass and meditation—or meditation first and then Mass—take approximately an hour and a half, breakfast can follow swiftly, say at seven-thirty or eight. An hour later occurs the morning's briefing on the topic of the day—discussing that which is to be undertaken, how best to encompass the subject. There is handing out of check-lists, and such keys and other helps as may be needed, these to be retained for future use when at one's own leisure and on one's own initiative—how much fun this is—one can probe the Great Out Doors fearlessly. There may be a going over of techniques, these never complicated for beginners. Finally the piling out into the midst of nature's presentation of the subject, which will occupy most of the rest of the day. Testing, distinguishing, classifying, naming, surprising their secrets (how the day speeds along!). There must be a half-hour's rest before lunch, (and incidentally a meal ticket from

the morning's collection will be required, a password given if one is to eat), then after lunch a period till two o'clock for private activities.

At two, there is a unique quarter hour called Quiet Appreciation Hour. There is complete relaxation, "Freedom in a prepared environment," said G. K. Chesterton, but he added, "complete rest—and exercise." In this little period, one of the senses is allowed full sway while the body remains still. The afternoon's further exercises end at four with a period till five devoted to class procedures and crafts. Questions and answers are grappled with here too in true Workshop fashion, on at least occasional days. Dinner is at six, campfire or play or show, a telling story or lecture or star study rounds out the day. Should such a program appear complex, strenuous, allowance can always be made.

We can now more readily grasp a skeletal outline of such a nature training course, with its red thread of religion woven in it, God's message from each particular phase of the outdoors. "How the Heavens show forth the glory of God, the earth declareth His justice." The rocks declare His eternity; the weather, His spirit; sunlight, His holiness; astronomy, His immensity; physics, His power; chemistry, His intelligence; trees that He is "ever ancient ever new"; flowers, His beauty; fruits, His bountifulness; ferns, His artistry; moss, His mercy; botany, His wisdom; mammals, the mystery of God; birds, His grace; cold-blooded animals, His justice; insects, His many-sidedness; mollusks, His hiddenness; zoology, His Providence.

AN ANNOTATED BIBLIOGRAPHY OF PAPAL PRONOUNCEMENTS ON SCIENCE

Ambrose Burke, T.O.R.

I. INTRODUCTION

The appropriateness of a bibliography of papal pronouncements on science in connection with this year's theme of the Franciscan Educational Conference (Nature: Mirror of God) is pointed up by two facts: The first is that Pope Pius XII is a Franciscan—a member of the Third Order—the second is that in the keynote address to the Conference Thomas A. Murray, Commissioner of the U.S. Atomic Energy Commission, refers to papal pronouncements as significant in scientific thinking.

The significance of science in the Pope's mind is borne out by an accounting of the total amount of material surveyed for the bibliography. While Sister Claudia's *Guide to the Documents of Pius XII (1939–1949)* lists only two items under the subject "Science," a perusal of her unpublished files covering the period January 1, 1949—June 1, 1955 reveals about 56 items running to a total of approximately 230 pages of text.

The Apostolic letter *Ad Deum per rerum naturae* of December 16, 1941, naming St. Albert the Great to be patron of science and scientific study, appears to be Pius XII's first pronouncements on science.

The content of the bulk of the Pope's pronouncements seems to fall into two general categories: a) Those characterized by an intimate and comprehensive knowledge of pure science; b) Those which show his concern for the application science, particularly with regard to moral application.

The practical purpose of the bibliography is to demonstrate to the members of the Conference the service the Library Section can render in preparing listings of references to aid those who are preparing papers for the program. The experience this year reveals that

the work of the librarians must be available as soon as topics are listed in preparation for selection of individuals who will prepare the various papers.

Part of the experiment was to undertake the bibliography as a cooperative project by a number of librarians. That element has not been as successful as had been hoped for. One of the difficulties was that for this particular undertaking only a little more than half of the potential material was in English. The percentage of the pronouncements of the Pope available in English in the past year and a half has risen sharply with the publication in this country of the quarterly *The Pope Speaks.*

Public acknowledgment is due Sister Claudia, I.H.M., Librarian at Marygrove College, Detroit, Michigan. She has graciously cooperated with Father George Hellman, O.F.M., and the writer in placing her files of the indexes to pronouncements of the Pope, published since the beginning of his pontificate, at our disposal. We would hope to reciprocate by granting her freely any usefulness accruing to her from our work with her very complete collection.

It now develops that this bibliography will not be developed to the point of the completion of annotations. The problem of approved translations enters into the picture and means, too, that pronouncements may be listed which do not have the desired usefulness. An index of persons, subjects, titles would be very important. In the hope that some usefulness will be found in the chronological list of the documents (as in Sister Claudia's *Guide to the Documents of Pius XII* [*1939–1949*]), that part of the work on the bibliography is here presented with the approval of Sister Claudia.

Some comments on the bibliography as here presented are in order.

In the listing of pronouncements for 1949 there is some duplication of items included in the Appendix of Sister Claudia's *Guide.* . . . In a number of instances additional texts or translations have appeared since 1949 and are included here to supplement what was already published.

It should be noted that though some of the material listed in this bibliography has been examined by either Father George Hellman, O.F.M., or Father Ambrose Burke, T.O.R., no record was made of that examination. Not every source of the text of pronouncements

listed in Sister Claudia's files has been put down. Usually preference was given to listing sources in English and to those publications more generally available. Again, because a more complete treatment was planned, with further consultation of sources, the record of selectiveness cannot be put down.

Some listings of titles from *Catholic Periodical Index* and Romig's *Guide to Catholic Literature,* particularly with regard to the Encyclical *Humani generis,* have been added to what we noted down from Sister Claudia's files.

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Latin

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English

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Latin

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French

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English

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French

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French

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12. **E sempre** (address) July 2, 1950 (AI lavoratori della società Romana di Elettricità).

Italian

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13. **Humani generis** (encyclical letter) August 12, 1950 (Some false opinions which threaten to undermine the foundations of Catholic doctrine).

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Latin

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French

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Italian

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English

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Catholic Action, 35 (June, 1953), 17–19.

Catholic Documents, no. 12 (July, 1953), 9–16.

Catholic Mind, 51 (July, 1953), 428–35.

Linacre Quarterly, 20 (November, 1953), 97–105.

32. **Soyez les bien venus** (address) June 7, 1953 (International Symposius on Genetics: [sterilization]).

French

Discorsi e Radiomessaggi, XV, p. 251–266.

English

Catholic Documents, no. 14 (February, 1954), 6–15.

National Catholic Almanac, 1954, St. Anthony Guild Press, p. 69–75.

33. **Répondant au vif désir** (allocution) June 12, 1953 (Iis qui interfuerunt primo Conventui Latino de ophtalmologia, Romae habito: [science in the service of humanity]).

French

Acta Apostolicae Sedis, 45 (30 Junii 1953), 418–22.

34. **Soyez les bienvenus** (allocution) September 7, 1953 (To participants in the International Symposium on Genetics: sterilization and the banning of marriage for persons with hereditary diseases).

Latin

Acta Apostolicae Sedis, 45 (8 Octobris, 1953), 596–607.

English

Catholic Documents, no. 14 (February, 1954), 6–15.
Irish Ecclesiastical Record, 82 (September, 1954), 191–200.
Liguorian, 42 (January, 1954), 45–8.

35. **En ce mois de septembre** (address) September 13, 1953 (To the 6th International Congress of Microbiology: scientists are "collaborators in God's Providence").

French

Acta Apostolicae Sedis, 45 (15 Novembris, 1953), 666–71.
L'Osservatore Romano, 93 (16 settembre, 1953), 1.

36. **Toutes les Fois** (address) September 19, 1953 (To the 18th International Navigation Congress: achievements of naval engineers).

French

L'Osservatore Romano, 93 (20 settembre 1953), 1.

37. **Col sentimento de predilezione** (address) October 1, 1953 (Italian national congress of nurses: on nursing and neuro-psychiatry).

Italian

Acta Apostolicae Sedis, 45 (30 Novembris 1953), 725–9.
L'Osservatore Romano, 93 (2 ottobre 1953), 1.

English

The Pope Speaks, 1 (April, 1954), 54–9.

38. **All' inizio del vostro corso** (address) October 4, 1953 (To Catholic doctors).

Italian

Discorsi e Radiomessaggi, XV, p. 355–59.

39. **Nous vous salouns** (allocution) October 8, 1953 (To the 26th Convention of the Italian Society of Urology)

French

Acta Apostolicae Sedis, 45 (9 Novembris 1953), 673–9.
L'Osservatore Romano, 93 (10 ottobre 1953), 1.

40. **Nous n'hesitons pas** (address) October 9, 1953 (To the International Federation of National Associations of Technicians: on technical education and its social aspects).

French

Discorsi e Radiomessaggi, XV, p. 381–88.
L'Osservatore Romano, 93 (11 ottobre 1953), 1.

English

Catholic Documents, no. 16 (December, 1954), 1–5.

41. **Arrivés au terme** (address) October 19, 1953 (To the 16th convention of the International Office of Documentation for Military Medicine; on medical ethics; condemns germ warfare, atomic and chemical warfare, euthanasia).

French
Acta Apostolicae Sedis, 45 (30 Novembris 1953), 744–55.
L'Osservatore Romano, 93 (21 ottobre 1953), 1–2.
English
Catholic Mind, 52 (January, 1954), 46–54.
German
Herder-Korrespondenz, 8 (December 1953), 125–9.
Italian
Civiltà cattolica, 104 (21 dicembre 1953), 462–9.

42. **Wir heissen Sie Willkommen** (address) October 23, 1953 (To a Danish delegation honoring Bishop Niels Stensen, priest-scientist: science and religion).
English
Catholic Mind, 52 (April, 1954), 255–6.

43. **Il popolo, che abitava** (radio address) December 24, 1953 (Christmas message to the world: on technology, machinery, science, and religion; materialism, work, the family; social action, the state, European unity, and peace).
Italian
Acta Apostolicae Sedis, 46 (16 Januarii 1954), 1–16.
L'Osservatore Romano, 93 (25 dicembre 1953), 1–2.
English
Catholic Mind, 52 (March, 1954), 174–83.
German
Herder-Korrespondenz, 8 (Januar 1954), 168–72.
Spanish
Razón y Fe, 49 (febrero 1954), 177–85.

44. **Nous sommes heureux** (address) April 4, 1954 (To participants in the 3rd Congress of Radiologists . . . and the 18th Congress of the Italian Society of Medical Radiology: recent advances in radiology; suffering.
French
Acta Apostolicae Sedis, 46 (28 Maii 1954), 214–18.
L'Osservatore Romano, 94 (5–6 aprile 1954), 1.
English
Catholic Documents, 17 (April 1955), 1–3.
National Catholic Welfare Conference News Service (April 8, 1954).
The Pope Speaks, 1 (July, 1954), 129–32.

45. **Non attrimenti** (radio address) April 18, 1954 (Easter message: plea for international agreements to effectively bar nuclear war, for dedication of science to peace.
Italian
Acta Apostolicae Sedis, 46 (28 Maii 1954), 212–14.
L'Osservatore Romano, 94 (19–20 aprile 1954), 1.
English
Catholic Documents, no. 17 (April, 1955), 4–5.
Catholic Mind, 52 (July, 1954), 438–40.
The Pope Speaks, 1 (July, 1954), 133–35.

46. **Pour apprécier la signification** (address) September 11, 1954 (To participants in the 3rd International Poliomyelitis Convention: psychological problems of polio victims).

French

Acta Apostolicae Sedis, 46 (15 Octobris 1954), 533–36.

L'Osservatore Romano, 94 (12 settembre 1954), 1.

English

The Pope Speaks, 1 (October, 1954), 237–40.

47. **Quingentesimus vicesimus** (address) September 11, 1954 (To members of the International Congress of the History of Pharmacy: Christian duties of pharmacists).

Latin

Acta Apostolicae Sedis, 46 (14 Octobris 1954), 536–40.

L'Osservatore Romano, 94 (13–14 settembre 1954), 1.

English

The Pope Speaks, 1 (October, 1954), 241–44.

48. **Parmi les nombreux Congrès** (address) September 17, 1954 (To the 14th Congress of the International Congress of Medical History: the Church's role in the history of medicine).

French

Acta Apostolicae Sedis, 46 (15 Novembris 1954), 577–80.

L'Osservatore Romano, 94 (19 settembre 1954), 1.

English

The Pope Speaks, 1 (October, 1954), 245–48.

49. **En accueillant la demande** (address) September 24, 1954 (To the 10th general assembly of the International Union of Geodesy and Geophysics: advances in the physical sciences; science and religion).

French

Acta Apostolicae Sedis, 46 (15 Novembris 1954), 580–84.

L'Osservatore Romano, 94 (25 settembre 1954), 1.

English

The Pope Speaks, 1 (October, 1954), 253–57.

50. **Le Congrès International** (address) September 29, 1954. (To the International Foundry Congress: progress in metallurgy; labor-management relations).

French

Acta Apostolicae Sedis, 46 (15 Novembris 1954), 584–87.

L'Osservatore Romano, 94 (30 settembre 1954), 1.

English

The Pope Speaks, 1 (October, 1954), 259–62.

51. **Nous sommes heureux** (address) September 30, 1954 (To the participants in the 8th International Convention of the World Medical Association: prevention of atomic warfare; peace; medical ethics; human experimentation).

French

Acta Apostolicae Sedis, 46 (15 Novembris 1954), 587–98.

L'Osservatore Romano, 94 (2 ottobre 1954), 1–2.

English

Catholic Mind, 53 (April, 1955), 242–52.

The Pope Speaks, 1 (January, 1955), 347–59.

52. **Les statuts de l'Union** April 7, 1955 (Iis qui interfuerunt internationale quarto conventui Unionis Medicalis Latinae, Romae habito: Christian tradition of the medical profession).

French

Acta Apostolicae Sedis, 47 (21 Maii 1955), 275–81.

English

National Catholic Welfare Conference News Service (April 14, 1955).
The Pope Speaks, 2 (Summer, 1955), 138.

53. Au moment (address) April 24, 1955 (To the Pontifical Academy of Science: progress of science; atomic science; mechanism; philosophy of science).

French

Acta Apostolicae Sedis, 47 (25 Junii 1955), 394–401.
L'Osservatore Romano, 95 (25–26 aprile 1955), 1–2.

English

Catholic Mind, 53 (October, 1955), 628–34.
National Catholic Welfare Conference News Service, (April 28, 1955).
The Pope Speaks, 2 (Summer, 1955), 113–20.
Tablet, 205 (June 11, 1955), 570–71.

54. **C'est pour nous** (address) May 13, 1955 (To participants in the International Symposium of Europe for the study and production of antibiotics, particularly terramycin: use of antibiotics in animal nutrition; food supply).

French

L'Osservatore Romano, 95 (14 maggio 1955), 1.

English

National Catholic Welfare Conference News Service, (May 27, 1955).
The Pope Speaks, 2 (Summer, 1955), 136–38.

55. **Il nous est agréable** (address) May 21, 1955 (To the International Association of Aircraft Builders: religious aspects).

French

L'Osservatore Romano, 95 (22 maggio 1955), 1.

English

The Pope Speaks, 2 (Summer, 1955), 139–40.

56. **C'est la quatrième fois** (address) June 10, 1955 (To the delegates of the 4th World Petroleum Congress: the petroleum industry; world economic relations).

French

L'Osservatore Romano, 95 (12 guigno 1955), 1.

English

Catholic Mind, 53 (October, 1955), 635–37.
The Pope Speaks, 2 (Summer, 1955), 159–62.

III. INDEX

(Titles of Pronouncements are in bold face type; numbers correspond to those of the entries in the bibliography.)

NATURE: THE MIRROR OF GOD

Sister Wilhelmette, O.S.F.

What is nature? A poetic definition might be: *Nature is a Book Written by the Loving Hand of God.* By nature we mean the entire material universe, created by God.

The theme for this Franciscan meeting: "Nature: The Mirror of God," is certainly an appropriate one. Msgr. U. A. Hauber, professor and head of the biology department at St. Ambrose College, Davenport, Iowa, under whom and with whom I worked for seven summers, is very emphatic about the fact that the term "nature" isn't written with capital letters. By this he means that we are not to accept the term as so many pagans do who make nature their God. Some like to think that Luther Burbank was such a pagan. However, it seems to me that he considered himself superior to nature. So did Albert Einstein. They certainly acted and spoke as though they had control over nature in certain fields.

The concept of nature as being the mirror of God is found in the writings of many great men. We find it in the writings of Plato and Aristotle. St. Anthony of Padua in one of his sermons says that God has given us three books; the book of nature, the book of Holy Scripture and the book of conscience. This is what he says about the book of nature:

> If at the moment of sunrise you were to walk out on some green lawn and look around you, you would see grass and leaves and flowers, all bathed in countless drops of dew. While the world sleeps, the dew-drops lie on the earth passive and at rest. But as the run rises and casts its beams on them, they disappear; and if we ask whither they have gone, the answer is a simple one: the sun has drawn them to himself; they have risen up to heaven. Such is the lesson of the book of nature, and the language in which it teaches us to give our first waking thoughts to God.

St. Francis and Nature

The book entitled *The Words of St. Francis* should be a must in every Franciscan community. It is compiled and arranged by James

Meyer, O.F.M.; published by the Franciscan Herald Press, Chicago 9, Ill. We are all familiar with St. Francis' "Canticle of the Sun." It seems, of all the brothers and sisters of nature, birds were his favorites. "My birds, you ought to praise your Creator mightily and always love Him." At Alverno he had some rivalry to contend with in the song of the swallows. To them he says so gently: "My sister swallows, it is time now for me to speak, too, for up to now you have talked enough. Now you hear the word of God and remain silent and quiet until the word of the Lord has been taken care of." When Father Francis saw a sheep among the goats, it reminded him of our Lord Jesus Christ among the Pharisees, and he would say to the Brother: "I beg you, therefore, son, to have pity on this poor little sheep with me for love of Him. Let us pay the price and lead her away from among these goats." The lark soaring in the sky, away from the earth, to him is a symbol of a soul living in close union with its Maker. I don't think a man or woman ever lived who saw God mirrored in nature as did our holy Father St. Francis.

There is, perhaps no class of writers who use this idea so much in their writings as do the poets of all ages. In general, the poetry of today is lacking in reference to the supernatural and to the guiding Providence of God. Although some of the poets of past ages were naturalists, they all refer to the spiritual in man and his relationship to God through nature. To contrast Cowper's supernatural strain with Wordsworth's naturalism, I will quote a few verses from each.

This is from Cowper's "The Task":

> God made the country and man made the town.
> What wonder then that health and virtues, gifts
> That alone can make sweet the bitter draught
> That life holds out to all, should most abound.
> And least be threatened in the fields and groves.

In the following verses from "Excursion," by Wordsworth one can see that he implied the convictions that Cowper put into words:

> For, the man———
> Who in spirit, communes with the Forms of
> Nature, who with understanding heart
> Both knows and loves such objects as excite
> No morbid passions, no disquietude———.

The poet Young says:

Read Nature; Nature is a friend of truth;
Nature is christian; preaches to mankind;
And bids dead matter aid us in our creed.

Shelley's poetry mirrors his naturalism more than it mirrors God. These lines from Bowles show conclusively that poets in their writings cannot get away from God:

———sense of quiet gladness,
Which in summer steals———
From quiet nook, and feels itself expand
Amid the works of Nature, to the Power
That made them.

At a meeting of this kind we want more of the real, the practical side which deals with the imparting to or developing in our charges a real appreciation of God's care for all His creatures, even the most insignificant ones.

Variety of Projects

There is an almost endless variety of projects that can be done even with children in the first grade. I have done some of these things with little children after school hours or in vacation. Ask them to bring all kinds of larvae; they call them worms. Put them into a glass jar with some soil, a twig and some of the plant on which they found them feeding. Hairy caterpillars are always plentiful. They can be placed in a shoe box with enough food. Encourage them to examine the inside of the box several times a day and watch them spin the cocoons. If they bring a large number there will be male and female. You'll never forget the wonder and sparkle in their eyes when, in the early spring or late winter they see a pretty white or colored moth crawl out of the cocoon. And more wonder when they see many small white, yellow, or lavender eggs plastered on the inside of the box or jar. While this is going on they will learn about the wonders and miracles of nature, such as, that each species makes a cocoon different from that of every other. They will learn and appreciate the power and providence of God that guides all these activities for their own good. They will also be able to observe the tiny caterpillars hatch from the eggs.

Another breath-taking surprise is the activities of the parasitic

insects. Let them bring some tomato worms as they call them. Put them into a glass jar with plenty of food. Perhaps the next morning they'll be looking for the escaped worms. They really haven't escaped. They don't know that they have crawled under the soil to pupate for the winter. After about a month let them empty the jar and find the pupae with a hard brown shell and a handle on one end. But more likely they'll have another surprise. Some day they will see most of the larvae covered with a hundred or more small white cocoons. The tomato worms have stopped eating and are almost dead. Then you can tell them the work of the little Brachonid wasp; how it helps to keep the balance of nature. They will bring flowers, with a few bees still clinging to them sucking the nectar. How wonderful that God gave the flowers color and perfume to make it easy for the bees to find their food.

One has many opportunities without teaching formal science, to interest children, even those of pre-school age in the beauties of nature, so that they are fascinated even by a snake. Try this. Walk around among children with a live snake in your hands. Invariably they will stretch out their little hands eagerly and with a pleading voice call, "Please, Sister, let me hold it." You can show them the beauty of the curves in the snake's body as it crawls on the floor.

Another activity that fascinates little and even older children is the study of seeds. The lima bean and the maple seed are excellent for the study of the miniature plant or embryo inside the seed. In the maple seed the leaves are bright green and long, attached to a tiny stem and there is also a root tip.

The child who is awake to the beauty and order of nature, holds the key to a knowledge of God's creation, and he sees the beauty and goodness of God reflected in nature. The beginnings of such knowledge are found in the home. Here he gains the understanding of the right use of nature, which is basic to the practice of conservation.

Even children in the first grade accept these facts: 1. God made all creatures. 2. God gave most animals the ability to get their own food. 3. Most animals are able to make the kind of homes they need. These may be dens, burrows, caves or holes. 4. Animals prepare for the winter according to God's plan for them. Msgr. U. A. Hauber capitalizes on this fact that animals and plants know exactly what

to do and always do it right. The only creature who can spoil God's world is man.

In the geography lesson one can tell the children how God prepared the earth for plants, animals and man through millions of years, by letting the forces of nature crush, crumble and powder the rock and thus prepare the soil for plant growth.

While we are using objects to teach nature, we must not forget the power that poetry has in teaching valuable lessons.

Beauty in Common Things

Look not far for beauty. Lo! it glows
In dew-wet grasses all about thy feet;
In birds, in sunshine, childish faces sweet,
In stars, and mountain summits topped with snows.

Go not abroad for happiness, for see,
It is a flower that blossoms at thy feet
Bring love and justice home, and then no more
Thou wilt wonder in what dwelling joy may be.

Dream not of noble service elsewhere wrought;
The simple duty that awaits thy hand
Is God's voice uttering a divine command;
Life's common duties build all that saints have thought.

In wonder-workings or some bush aflame,
Men look for God, and fancy Him concealed,
But in earth's common things He stands revealed,
While grass and stars and flowers spell out His name.

For the sake of emphasis I'd like to repeat what I have said, by summing up in one paragraph the main thoughts of this paper.

In all these activities and studies and hobbies the child comes to realize the power of God in creation, and the goodness and love of God in providing so generously for all creatures. Children come to see that every creature obeys the law of God; yet all these creatures except man aren't free. They can be brought to realize that only man can choose to disregard the plan of God, and when he does there is havoc in nature. Because of his freedom in acting, only man can attain to the great happiness, which is the reward for freely helping to work out God's plan.

SCIENCE CLUBS IN CATHOLIC HIGH SCHOOLS

Sister Mary Michelle, O.S.F.

I. Definition

According to Webster, a club is "an association of persons for the promotion of some common object, as literature, science, politics, good-fellowship, especially one jointly supported and meeting periodically." Muroff [1] defines a club as "merely a group of individuals with the same interest, under the leadership of an enthusiastic sponsor." In a slightly more descriptive manner it is stated in the *Encyclopedia of Modern Education* [2] that school clubs are "organized groups of students whose interest and program center about some particular subject or activity, often beyond the scope of the regular curriculum."

A working definition, which combines the modern concept of science with the definition of a club, has been developed by Geiser.[3] "A science club," he writes, "is any group of pupils organized to pursue in an interesting, exciting, and orderly manner a definite program of scientific appreciation, investigation, and experimentation, under able and enthusiastic leadership and guidance."

II. Purposes

The purposes of science clubs will be as varied as the clubs themselves. There are, however, a number of objectives which may well form a part of the aim of each and every science club.

A. The science club, like every other phase of school activity, must contribute to the achievement of the objectives of Catholic Secondary Education or there is no justification for its existence.

[1] J. M. Muroff, "Activities for a Science Club," *School Activities,* XIII (1942), p. 254.

[2] Harry D. Rivlin, *Encyclopedia of Modern Education,* (New York: F. Hubner & Company, 1943), p. 149.

[3] Donald L. Geiser, "The Importance of High School Science Clubs," *School Activities,* XXV (1954), p. 217.

These objectives, formulated by the National Catholic Education Association, are as follows:

1. To develop *intelligent* Catholics.
2. To develop *spiritually vigorous* Catholics.
3. To develop *cultured* Catholics.
4. To develop *healthy* Catholics.
5. To develop *vocationally prepared* Catholics.
6. To develop *social-minded* Catholics.
7. To develop *American* Catholics.[4]

B. "Clubs have the opportunity to supplement the work of the school. In classes there are many interests and possible activities for which time does not permit. Carrying on such unfinished business in clubs supplements and reinforces the instructional program." [5]

C. The science club affords opportunities for pupils to explore new interests and fields of knowledge which might otherwise remain uncharted regions to them.

D. There is opportunity for self-expression and initiative in club activity, as well as for learning how to work with others with its subsequent improvement in student personality. "The social and psychological nature of adolescents make them especially interested in this opportunity for activities which involve group activity and social cooperation." [6]

E. The science club is in a position to offer aesthetic, emotional and intellectual satisfaction to its members, encouraging them to be more than "lever-twiddlers, button pushers, and knob twirlers, enjoying but not comprehending the products of the prodigious labors of a comparatively few men." [7] Well-planned club work will foster critical thinking, scientific honesty, and scientific method.

F. Students can be taught through club experiences to be "heralds of God by calling attention to His majesty, His power, His beauty,

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[4] A. F. Schnapp, "Objectives of Catholic Secondary Education," *Catholic School Journal,* XL (1940), pp. 148–49.

[5] M. L. Goetting, *Teaching in the Secondary School,* (New York: Prentice-Hall, Inc., 1942), p. 471.

[6] *Ibid.*

[7] H. M. Davis, "Liberal Education and the Physical Sciences," *The Scientific Monthly,* LXVI (1948), p. 421.

His goodness, His love." [8] "Science, as presented by the Catholic teacher, should lead through awe and wonder at the marvels of Creation, to reverence and adoration of the Creator." [9] This should be especially true if the club is guided by a teacher who boasts a Franciscan heritage.

G. Club work can be a powerful factor in preparing young people for articulate, apostolic Catholic adult living. The club, guided by its sponsor, "has a unique opportunity of stressing the idea of God's Providence, as distinct from ideas on His perfection and other attributes. This doctrine, if once understood and grasped, could permeate life, bringing spiritual fruitfulness." [10] As a consequence, the student can be a leaven in adult life for the Christ-life. He will have learned to speak, to work with others, and to spread Catholic teaching, on, for example, the relation of science to faith, the morality of the biological aspects of life, and the truth of a Creator and of Providence.

H. One of the principal aims of Science Clubs of America has been the cultivation and recognition of special scientific talent and ability. The qualities which must be sought in the prospective scientist and which the teacher may note readily in certain members of a science club are:

1. *A high degree of innate curiosity.* One cannot spend the long hours required in the pursuit of research problems unless there is an enduring interest and curiosity.
2. *The ability to detect an incongruity or inconsistency.*
3. *Power of intuition,* i.e. capability of offering tentative explanations that can be tested by experimentation or further observation.
4. *Manual dexterity.* The vast amount of laboratory work with its attendant use of complex pieces of apparatus necessitates a certain amount of manipulative ability or mechanical mindedness.

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[8] Hilarin Felder, O.F.M.Cap., *The Ideals of St. Francis,* (Chicago: Benziger, 1925), p. 423.

[9] M. T. Marnane, *A Guide for Catholic Teachers,* (M. H. Gill and Son, Ltd., 50 Upper O'Connell Street, 1952), p. 109.

[10] *Ibid.,* p. 111.

5. Embodied in all these traits is the foremost quality which every scientist must have, namely, *integrity*.[11]

III. Organization

If the science club is considered desirable in a given situation, its organization should follow in logical sequence. "Good clubs are the result of careful planning and efficient execution. However, organization must be a means of economizing time and not so elaborate that it interferes with activity and defeats the goal for which the club has been started." [12]

It is not necessary for the club to have a constitution. However, the writing and the adoption of a constitution are broadening experiences which could prove beneficial to the student in his post-graduate contact with religious and civic organizations. The constitution should embrace all the elements which will remain the same from year to year, such as, name, aims, requirements for membership, election and duties of officers, meetings, dues and money, and provision for programs.

In addition to the regular officers of president, vice-president, secretary and treasurer, there may be a librarian whose duty it is to care for and store supplies, apparatus, and equipment possessed by the club, and a reporter who handles the publicity of the club. The secretary, who is the historian, must keep permanent records of all meetings and transactions.

It is recommended that the sponsor of a successful science club possess the following qualities:

1. A good science club sponsor must be a highly skilled leader, competent in his field. However, he must be willing to realize that there may be members of the club who are better informed on a certain subject than he. In this world of rapidly developing science, when youth begins to specialize early, this situation is to be expected.
2. Enthusiasm is a prime requisite for the science club sponsor.

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[11] Sister Helene, C.H.M., "Science and Today's Youth," *Catholic School Journal*, LIII (1953), pp. 121–22.

[12] Margaret Patterson, ed., *Science Clubs of America Sponsor Handbook*, (Washington, D.C.: Science Service, 1956), p. 3.

Recognizing the fact that the success or failure of a club will depend largely upon the enthusiasm of the group, the sponsor will take care to nourish his own spirited attitude, for it is a weighty factor in maintaining the enthusiasm of the group and directing it into profitable channels of endeavor.

3. Each member of the club must feel that the sponsor takes a genuine, friendly, optimistic interest in him and his problems, but at the same time retains impartial judgment toward all. There is nothing like a word of appreciation to encourage a student to renewed effort.

4. Good health and an abundant sense of humor are practically indispensable. Since science clubs are almost always on a voluntary basis, the sponsor must accomplish with common sense, good humor, enthusiasm and friendliness what a less gifted leader would do with strict discipline.

5. A good sponsor must be acutely conscious of the vantage point which his position gives him in the molding of leaders of scientific thought, realizing that "only Christian leadership at top scientific levels will insure the Christian application of scientific knowledge." [13]

Yothers [14] suggests that during the early stages of the club's formation the sponsor should take an active, interested part in organizing and directing the group but that this should be done mainly through suggestion rather than through precept. "If the club is to accomplish positive results with students, the adviser must not dominate their thinking and action. On the other hand, it would be equally unwise for the teacher to withhold from the group the benefits of his broader training and experience." [15]

IV. Administration

A. Organization within the school

Before any club may be organized and permitted to function in the school, the plan must have the approval of the school adminis-

[13] Dr. O. A. Battista, "Should My Son Be a Scientist?", *Ave Maria* (August 27, 1955), p. 9.

[14] Lee R. Yothers, "Biology Clubs and Projects," *The American Biology Teacher*, LVII (March, 1955), p. 110.

[15] *Ibid.*

trators. With the cooperation of school executives and teachers, the problems of time, place, and frequency of meetings can be solved.

The most popular headquarters for science clubs are in school laboratories during or after school hours. The club headquarters should be open to members after school hours and on free days so the members will have a chance to work whenever they are free to do so.

The frequency of the meetings is decided by the members, subject to the approval of the sponsor and the principal. Too frequent meetings are a burden. On the other hand, if meetings are spaced too infrequently, interest tends to lag. Some clubs meet every week. Others meet every two weeks. Still others convene at monthly intervals.

In determining who will be permitted to join the club, ability and interest in science are the chief criteria. The chronic club-joiner, who is merely interested in adding to his collection of pins, should be excluded. Some sponsors, in an effort to enroll students with talent in science, require that the prospective member be working on a scientific project. Others restrict membership to pupils in science classes. In any event, those students who would be a detriment to the purposes of the club are unqualified for membership.

Clubs range in size from three members to seven hundred. The average club affiliated with Science Clubs of America has twenty-seven members.[16] If club meetings are devoted to lectures, hundreds can be accommodated. If laboratory work is to be done, the amount of equipment and the size of the available rooms will be determining factors. Large groups can be broken into smaller units, so that each can pursue its own interests.

The kind of club, whether it be photography, aeronautics, radio, electronics, or any other type, will depend upon the ages and interests of its members, and the qualifications of the adult sponsor. The younger the members, the more varied their interests are likely to be, whereas, members who are aged fourteen and over usually settle on some definite field for study. The kind of club formed, then, will have to be determined in a democratic manner, that is, by the majority.

[16] Patterson, *op. cit.*, p. 4.

B. Method of functioning

The club meeting itself may be divided into two parts, the first five or ten minutes devoted to the business meeting and the next thirty or forty to the program. The business matters of the meeting should be so well planned by the officers or committees before the meeting that time is not wasted in unnecessary deliberation and discussion. The program section of the meeting may be devoted to a lecture by a guest speaker. This may be followed by a lively question period, reports on scientific subjects by members, films or film strips, a field trip, discussions of current science, demonstrations, explanations of projects undertaken by club members, reports on the lives of great scientists, or a work period on group or individual projects.

The *Sponsor Handbook of the Science Clubs of America* advises that "the responsibility for the operation of the club program be neatly partitioned among the members and the sponsor so that the latter is generally the adviser and the members have ample chance to enlarge their sense of responsibility to duty and to practice the methods of leadership which are essential today." [17] Members will enjoy the club to a higher degree if they are permitted to take an active part in planning and executing the necessary work of the club. Consequently, whenever possible, committees should be appointed to facilitate the completion of a club task. Clubs that have officers or a sponsor that do all the work may be efficiently administered, but they do not exist for the good of individual members. Each member must feel that the success of the club depends upon his own effort. This attitude can be achieved by assigning tasks to everyone and expecting prompt and efficient action from each.

It must be the aim of the sponsor and officers of the club to encourage every member to undertake a scientific investigation or project of his own. Aiding students to find problems or projects which interest them and guiding their thinking to the desired solution is the responsibility of the sponsor. He can also make available material which might otherwise be difficult for the student to procure. If students are to receive full benefit from their experiences

[17] *Ibid.*, p. 3.

with projects, however, they should be aware of the following four factors:

1. They must know what they want to do.
2. They must know if the solution of their problem is possible of accomplishment by them.
3. They must know how their problem can and should be solved.
4. Upon completing their projects, the pupils should recognize or sense accrued values.[18]

Furthermore, it is always a source of encouragement to the student to know that his project can be used in some constructive way. The following suggestions are given by Yothers: [19]

1. A school assembly program offers an excellent opportunity for displaying outstanding student work.
2. Exhibits may be displayed in school corridor cases, school and city libraries, museums, colleges, and educational conferences.
3. Suitable students' projects should be used in the regular class work.
4. Projects may be used to stimulate student participation in science fairs and talent searches.

Science fairs are attracting more and more clubs. The first national Science Fair was held in Philadelphia in 1950. Participating were thirty finalists from thirteen areas of the United States. In May, 1956, more than 200 young scientists from 100 areas are expected to appear in Oklahoma City to vie for $1,000 in awards of their choice.[20]

A science fair is essentially a science exhibit which is held in some locality easily accessible to a number of high schools. Colleges are especially suitable places, for they can provide the required facilities. A period of from one day to one week is given over to presenting outstanding science projects to the public, as well as to parents, students, and teachers.

The purposes of the science fair are:

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[18] Yothers, *op. cit.*, p. 110.

[19] *Ibid.*

[20] Watson Davis, ed., "National Science Fair," *Science News Letter* (October 8, 1955), p. 229.

1. To focus attention on science.
2. To stimulate student interest in science.
3. To motivate the student to make discoveries.
4. To encourage and inspire in youth the desire to think scientifically.
5. To offer an opportunity for display of scientific talent through exhibits and demonstrations.
6. To recognize talented youths without exploiting them.
7. To encourage further work in the field of science in college and industry.[21]

Included in the program of the science fair there is often the opportunity to hear lectures and see demonstrations given by representatives of various industries. Sometimes, too, the latest in scientific films are shown. The item of prime interest is viewing the exhibits of the young scientists of the area.

Awards to students for outstanding exhibits at science fairs take the form of scholarships and scientific equipment.

According to Margaret Patterson,[22] executive secretary of Science Clubs of America, "the whole science fair program is educationally sound. It allows the student to select freely the project upon which he plans to work. Automatically he leads himself through a study of the bedrock principles of his chosen topic, to a basic, fundamental understanding of the facts and techniques involved. All elements of a stiff competition are present to urge the student to do his best. . . ."

Further opportunities are afforded young scientists by the Junior Academies or Councils of Science which are organized in some states. Membership enables students to participate in the annual convention, in science essay projects, and in other activities of the organizations. Science talent searches, both on the state and national level, serve to locate and stimulate latent scientific talent.

V. Evaluation of Outcomes

It must be concluded "that a widespread liking for science is engendered by the natural inquisitiveness of youth combined with

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[21] "Science Fair," A Publication of the Science Departments, Marycrest College, Davenport, Iowa.

[22] Patterson, *op. cit.*, p. 27.

the intensely scientific flavor of our times." [23] Tremendous impetus in group effort in science has stemmed from the organization of science clubs, which total over 15,000 in the nation's secondary schools and serve a third of a million boys and girls.[24]

In reply to inquiries concerning the success of local science fairs in finding the boys and girls who will be the nation's future scientists, a questionnaire [25] was sent to 163 finalists. Returns of this questionnaire indicate that four out of every five finalists are pursuing scientific studies.

"One of the outstanding values of a club lies in getting pupils away from the sole use of the textbook and giving them the opportunity to work with their hands and with their minds, both alone and in cooperation with fellow students. . . . While the construction of projects is a temporary phase of a student's academic life, their meaning is permanent, often expansive through increments which further self-growth." [26]

The Reverend J. Franklin Ewing, S.J., of Fordham University, asserts that the study of science and scientific research should be presented to students by Catholic educators as a vocation. "I submit," he writes, "that the most important need of the Catholic Church in this country is for the growth of a large body of intelligent, intellectual lay people; and, of these, in terms of our civilization, the most important need is for scientists. For these people, especially the scientists, this life is a vocation to learning, a calling by God, and the most important thing we can build up today in this country." [27]

The obligation to foster the development of talent in science rests with the classroom science teachers. These teachers, however, cannot imbue others with the love and beauty of science unless they have an innate conviction that science has more to offer than de-

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[23] Margaret E. Patterson, "Clubwork Makes Science Fun," *Science News Letter,* LVI (1949), p. 186.

[24] Watson Davis, ed., "Science Minded Youth," *Science News* Letter, LXV (1954), p. 62.

[25] Watson Davis, ed., "Science Minded Youth," *Science News Letter,* LXV (1954), p. 293.

[26] Yothers, *op. cit.,* p. 110.

[27] Editors, "Science is Vocation," *Catholic School Journal,* LIV (May, 1954), p. 22A.

struction of moral and material forces. Teachers would do well to heed the counsel of Pope Pius XII: [28]

> . . . By your research, your unveiling of the secrets of nature and your teaching of men to direct the forces of nature toward their own welfare, you preach at the same time in the language of figures, formulas, and of discoveries, the unspeakable harmony of an all-wise God. In fact, according to the measure of its progress and contrary to affirmation advanced in the past, true science discovers God in an ever increasing degree as though God were waiting behind every door opened by science.

VI. Aids

A

1. *Careers in Science Teaching.* Free.
2. *Encouraging Future Scientists:* Materials and Services Available in 1954–55, 50c.
3. *Encouraging Future Scientists:* Student Projects, 50c.
4. *More Science Teaching Ideas.* $1.00 to N.S.T.A. members, $1.50 to non-members.
5. *The What, Why, and How of the Science Achievement Awards for Students and Science Teacher Recognition Awards.* Free.
6. *If You Want to Do a Science Project,* 50c (for orders of 2 or more, 25c).

Address: National Science Teachers' Association, 1201 16th St., N.W., Washington 6, D. C.

B

1. *Thousands of Science Projects,* 25c each; 10 copies $1.00.
2. *Science Exhibits,* $2.00.
3. *Scientific Instruments You Can Make,* $2.00.

Address: Science Clubs of America, 1719 N. Street, N.W., Washington, D. C.

C

Methods of Conducting a Science Fair. Free.

Address: Cambosco Scientific Company, 37 Antwerp St., Brighton 35, Boston, Massachusetts.

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[28] Pope Pius XII, "Modern Science and the Existence of God," Address of the Holy Father to the Pontifical Academy of Science, *The Catholic Mind,* L (1952), p. 182.

D

1. *Biology Projects,* Revised, 1948 Ed., 61 projects, 160 pp., $2.10.
2. *Chemistry Projects,* Revised, 1947 Ed., 43 projects, 176 pp., $2.10.
3. *General Science Projects,* Revised, 1941 Ed., 39 projects, 143 pp., $2.10.

Address: Science Publication, 201 N. School St., Normal, Illinois.

E

1. *In Quest of Truth*—A play in two parts, 25c.
2. *The King of Plants*—A play for science clubs, 25c.
3. *In a Sound Studio*—A play for physics or music, 25c.
4. *The Triumph of Science*—A play for the auditorium, 25c.
5. *The Radical Dream*—A mathematics play for puppets, 20c.
6. *Extracting Aluminum*—A one act chemistry play, 15c.
7. *Mock Trial of B Versus A*—A play for mathematics clubs, 30c.
8. *A Scientific Assembly Program: Wonders of Science,* 30c.
9. *Atomic Energy*—A play in three scenes, 25c.
10. *100 Topics in Mathematics*—For program or recreation, 25c.

Address: School Science and Mathematics, P.O. Box 408, Oak Park, Illinois.

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DISCUSSION

ROCH RAIBLE, O.F.M.CAP.:—Science clubs are educational tools of a major value. Like all methods of teaching they are only tools that supplement but do not replace any part of the given science course. I think the science club is an even better tool than all our modern audio-visual materials. In the projects sponsored by the science club, the students have firsthand contact with the phenomenon they are observing. Certainly it is much better to witness the actual emergence of a butterfly from the cocoon than to watch a movie of the same event.

A science club is close to me, hence my observations and experience may supplement the above paper. At Saint Fidelis Seminary the Cardinal Bird Club was established in 1948. It had a twofold purpose in its origin. It was intended to extend a scientific research project carried on by an individual member of the faculty to the students; and at the same time, it promoted an extra-curricular project of the biology class. The club is very specific in its purpose: to study the population, migration, and age of the species of birds, resident and transitory, in the area of Saint Fidelis Seminary. This is done by co-operating with the Bird-Banding project of the Fish and Wildlife Service of

the United States Department of the Interior. Officers of the club are limited to the biology class—sophomore high school—but actual membership extends even to a few individuals in the sophomore college. Under my direction the boys build the necessary traps, decide the best location for the traps, band the birds caught, and record the necessary data. We band on the average of one thousand individual birds a year, representing some ninety species. We have in our files records of some fifteen thousand individual birds.

Formal meetings are necessary. Election of officers, reports of group leaders on birds banded, discussion of better trapping methods, and simpler handling of the birds are all treated. For the new members, a study of bird identification is essential, since identification must be positive before banding is permitted. Individual projects of research are gleaned from the files and reported on at the regular meetings. So useful has the bird-banding program been as a genuinely scientific research project, that the material was readily accepted for my own Master's Dissertation at Catholic University.

Does the Science Club help reach the theme of the Educational Conference, Nature: the Mirror of God? Again let me use my personal observations. The reaction of new members after a month or so of active participation in the Bird Club is typical. They are at first surprised at the number of birds. The variety of species is a revelation: "Father, I had no idea there were so many kinds of birds."

An appreciation of nature follows from the work of banding. The boys quickly learn which birds are insect eaters, grain eaters, seed eaters. And so the multiplicity of insects and seeds of wild flowers and their control by various birds are grasped by the boys, even before these notions are developed in the regular biology course. A balance of nature reflects the wisdom of God; his bounty is seen in the magnitude of food available to the birds.

The beauty of nature is seen in the birds; this beauty is quickly noted by the boys. When a new species is trapped, the boys invariably note the striking colors. They are proud to trap the colorful birds: the cardinals, goldfinches, blue jays—even though these more common birds are not striking so far as the purpose of the project. With but a gentle hint, the boys can see some of the attributes of God as mirrored in nature. A Science Club, since it keeps a voluntary interest in nature alive, is a splendid means to such an end.

THE TEACHER EVALUATES HER STUDENT

Sister M. Aquinata, S.S.M.

The artist looks at his painting and touches it up here and there to bring out the perfect image represented to his mind's eye. The seamstress views and adjusts the garment to meet the high degree of beauty and form of the figure of the person who will wear it. So too, the teacher looks at and evaluates the workmanship of her art, the student nurse. However, one may object and say that there is a vast difference between working with canvas or cloth and working with a student who happens to be a human being.

The student, you will say, is not a mere material object nor can she be worked upon as such, for she is the product of both the human and divine creation, which is love. One immediately feels a certain reverence and respect for the role which the teacher plays in forming the heart, mind, character and personality of this student who will be a nurse.

It is not intended here for me to define a nurse. I am sure that each one has his own opinion and definition of what he thinks a nurse is or what a nurse ought to be. Since a student nurse is a "nurse-in-the-making," I would like to trace briefly and see how this person has come to be just what she is, a student nurse in a particular school of nursing. We are all familiar with the numerous and varied programs now being offered to persons interested in "taking up" nursing as a vocation or career in life. If one should inquire or make a visit to a high school or perchance speak to some girls at their "Future Nurses Club" meeting, one would find that the girls would say that they are thinking seriously about nursing and have been interested in it for a long time. With all the zeal and enthusiasm of our modern youth they are anxious and earnest to prepare themselves for this important step, namely that of entering the Nursing Profession.

Self-Sacrifice

An outstanding characteristic in the young girl who comes to the school of nursing is, that she is not looking for something that is easy. She knows before she applies that the person who wishes to become a nurse, puts in, perhaps not longer hours than the average office girl but that her hours are not routine nor always convenient and to her personal liking. She knows that nursing service is a public service in the sense that service must be covered every hour of the day, every day of the week and every week throughout the 52 weeks of a year. Regardless of how progressive the times are, the future nurse knows that "the sick will be always with us." Who, but one with a spirit of self-sacrifice and noble aspiration, would choose to be a nurse from the outward evidence alone. From this one can see that the person who has chosen nursing as her future career would of necessity be one with a maturing insight on life and life's problems. Already as a junior or senior in high school, she wants to know not what she can "get by with," but rather what the entrance requirements are, which will help her to have a solid foundation in order to become that future nurse. Here is where the nurse and non-nurse educators can do a great deal by informing the high school student of the requirements even before she has applied to a school of nursing. If she is informed early enough that she must meet college entrance requirements, and she indicates by her grades and by her scholastic achievement that she is capable of handling a program of studies as that set down by a school of nursing, one then must try to determine and thus reassure her as well as the school that she is equipped mentally, physically, and emotionally for the nursing profession.

Personality Characteristics

After the applicant has passed the entrance examination and fulfilled all due requirements she then makes the immediate preparation for entrance to her chosen school of nursing. At this time let us look at one of the criteria used for screening or evaluating the future nurse, namely the personality characteristics of the Psychological Aptitude Test. We are told that research has shown that ninety percent of all dismissals in industry are due to personal

reasons and only ten percent to incompetency. From this we can see how important personality characteristics are in success. But, of course, since personality is complex it is very difficult to evaluate, although not impossible. However, we need not compare our notes with industry because those of you who have had anything to do with nurses or nursing know from experience that it isn't the uniform, nor is it the academic achievement nor is it technique alone which makes an individual a good nurse or a poor nurse, but rather it is all of the above factors plus the personality characteristics which make up the individual.

Over the years that I have been in contact with student nurses, both formally in the classroom and informally at extra-curricular, or so called, co-curricular activities, the thought has occurred to me: Why are some nurses said to be "good" and others, putting it mildly, are just "not wanted." Is it because they have not been taught the proper technique, or is it because of their attitude and manner of behavior, or is it both? To be sure it is not lack of efficiency and technique alone, but you will no doubt agree, it is first and foremost the person's attitude and personality traits combined with technique and the interpersonal relations of the nurse.

Although the nurse instructor is not the guidance person in a school of nursing, as such, there are many opportunities whereby she can guide and assist the student who may have personality difficulties in the performance of her duties. One who deals with persons a great deal soon learns that true personality characteristics do not always reveal themselves during an interview and that they may not show up during the first weeks or year in an educational program, however during a crisis—pressure of work, a severe reprimand or insurmountable conflict are the stimuli for uncovering the true personality traits of a person. It is with this in mind that a study was made concerning the personality characteristics of a group of approximately three-hundred student nurses in a school of nursing. The sample was taken over a period of six years, from 1950 to 1955 inclusive. The personality characteristics as rated and evaluated attempted to measure the student's objectivity, agreeableness and cooperativeness on a percentile basis. The data is taken from the Psychological Aptitude Text, from Temple University, Philadelphia, Pennsylvania. According to Doctor Smeltzer's "Man-

ual of Interpretation" of the Personality characteristics, he states, "It is much easier to describe personality characteristics than to identify them by a single name or word. For that reason the three terms, objectivity, agreeableness, and cooperativeness should not be interpreted too literally." He further says that "an applicant who scores high on objectivity tends to view herself and her surroundings realistically. She faces reality. One who scores low may take many things personally. She is apt to be prejudiced and she is likely to overrate herself. It must be emphasized that an applicant who scores high on this trait may not always accept facts and reality, but at least she does know how to do it.

Dr. Smeltzer continues: "an applicant who scores high on agreeableness is usually compliant. She does not dominate. She does not want to be the 'whole show.' She does not fight over trifles. One who scores low has a great desire to be superior. She may dominate to attain superiority. Almost anything that inflates her ego or makes her feel important is liked." He says further that: "it must be emphasized that a high score does not guarantee agreeableness, compliance, and no domineering qualities, but at least the applicant does know how to behave in such a manner."

Cooperativeness

The third character trait is cooperativeness. This is interpreted to mean, "an applicant who scores high in cooperativeness tends to be tolerant and is likely to be pleasant. She tries to accept people and conditions as she finds them. She is not fault finding or hypercritical. One who scores low tends to be intolerant. She may have a strong desire to change many things to suit herself. She is apt to be hypercritical and fault finding. Once again it must be emphasized, says Dr. Smeltzer that "a high score does not guarantee cooperativeness, tolerance and pleasantness, but at least those who score high do know how to behave in such a manner."

Now I shall relate the findings of our test sample of applicants who were tested in the years 1950, 1951, and 1952, and who are now Registered nurses. Their Objectivity score ranged from a high percentile score of 95 to a low score of 10. The group average score was 44. The Agreeableness score ranged from 95 to a low score of 5

and the average score was 69%. The Cooperativeness score ranged from a high 95 to a low 25 averaging a score of 61 percentile. From this sample one could say that the applicant who was accepted into the School of Nursing and who has successfully completed her nursing education has some marked variation in her personality pattern and character make-up. Some applicants have high percentile scores and indicate desirable personality characteristics, others have low and with some undesirable personality patterns. The fact that all have graduated within the past three years does not mean that all have acquired or maintained the same degree of desirable personality traits. Having known each of them personally, having taught them and having been closely associated with them in both the classroom and on the nursing service division of the hospital, I feel competent in saying that in almost every instance where there was a very low objectivity, agreeableness or cooperativeness score the student as well as the supervisor and co-workers have experienced more than usual difficulty relating to the student. Besides having to make a greater adjustment the student has not always succeeded in becoming the "good" nurse which the patient, the doctor or the supervisor would like to have. However, it must be said that in view of her limitations she has succeeded in passing her state board examination and this even with a very high score as observed in a specific instance.

An interesting factor observed from the study is that the average personality for the group at large, ranges around the fiftieth percentile. Objectivity ranging lowest at 44%; Cooperativeness highest at 69% and Agreeableness medium at 61 percent. By interpreting these scores the teacher or guidance person would be able to see that as a group she is dealing with just average persons.

Since the above sample was taken from only those applicants who have completed their nursing education and are now registered nurses it may be of interest to know how the present student body manifests its personality characteristics. This group of 150 students comprises one third seniors, one third juniors and one third freshmen who were admitted in September of 1955. One cannot predict which of these will not complete her nursing education but according to the law of averages this school also has its annual rate of withdrawals. These are the scores as obtained from this group of student nurses. The Objectivity score ranges from 93–15% with an all school

average percentile of 55. The Agreeableness score ranging from 95 to 20 with an average percentile of 77 and Cooperativeness ranging from 100 to zero and averaging a 63%.

When comparing the personality scores of the applicants who are now students with those who are now graduate nurses we find that the average student today rates eleven points higher in Objectivity, ten points higher in Agreeableness and two points higher in Co-operativeness. If we apply the interpretation of these scores it would mean that in general the present student nurse is more objective, and tends to view her surroundings more realistically by eleven points than the graduate group. The present student nurse is more compliant, by ten points, and does not tend to dominate or to be as much a "show off" as her senior R.N. and lastly she ranks two points higher on cooperativeness, tolerance and pleasantness.

Conclusion

What a conclusion, if any, may the teacher or guidance person draw from the above findings? If it could be taken for granted that the sample was adequate, would it mean that the personality characteristics of the present day student nurse show her to be more objective, more cooperative and more agreeable? It would be a hopeful conclusion and no doubt a desirable one if valid and reliable. However, in view of the fact that the first sample was taken from only those applicants who had completed their nursing education and it did not include those who had withdrawn from the school before completion, the question arises, what percentage of those who withdrew did so because of personality inadequacies. The study could further be developed so as to try to determine the correlation between students with extreme personality scores and the reason for their withdrawal. Another factor would be to try to determine whether the student who withdrew was now happy and satisfied with the decision she had made or has she regretted the step she had taken. These and various other factors may be of interest and significance to the guidance person could they be studied and be of prognostic value to the admissions and promotions committee members of a school of nursing faculty.

Since we are concerned mostly with the student nurse as she is progressing in her learning activities here and now, and also how we as instructors and guidance persons can help to promote the

student's positive personality characteristics, I believe it would be well to frequently make a study of each individual student, not only academically and practically but most especially as she is personally. If we would try to see her in the light of the true human nature of each individual person, touched with the superabundant "dose" of God's actual and divine grace in her soul. When the nurse instructor or supervisor views her in this light and then evaluates her student, she will not just look to see if she is technically competent, resourceful, orderly, economical, accurate, skilled and so forth. She will try to see whether she, as a guidance person, has helped her student to become more resourceful, more accurate as a result of her association with her.

Then also she will evaluate her not only to determine if she is emotionally mature but rather to see whether she has helped her to grow more poised, more self-controlled, more sincere, more open-minded and capable of inspiring greater confidence by virtue of her association with her student. If the nurse instructor or supervisor understand that personality characteristics are the outgrowths of interpersonal relations between two or more individuals she too will see her student from a more realistic point of view. She will find her student growing more and more dependable, more thorough and more conscientious. She will find that her student will want to assume more responsibility for her own conduct, for her own work and for her own learning. If the interpersonal relations between the student and her teacher, her guidance person, her doctor or her superviser are good and wholesome they will find that she will become the kind of a nurse that the patient is looking forward to see. The student will also then find herself to be more tactful, more cooperative, and more pleasing at all times. To be inspired with noble motives is to be happy in one's activity and behavior. For to be happy in one's work is to be well adjusted. To be well adjusted is to be a success. If we as teachers, supervisors and nurse educators can help these young girls to find happiness in the vocation which they have chosen, how happy we too will be, to be doing God's work not only for God's sick but for God's children who hold the title of our Lady the "Help of the sick and Hope of the dying." Happiness and joy are marks of a true Franciscan. We too can promote the spirit of St. Francis as Nurse Teachers and Instructors.

PATRON SAINTS OF THE SCIENCES AND SCIENTISTS

Sister Mary Germaine, S.S.M.

The Patron Saint

While considering the steady progress man has made in the developments in science, it is well to focus our attention on the accomplishments of men and women who attained a high degree of sanctity through their prayers and labors which they performed in accordance with God's holy will. The Church encourages us to imitate their virtues, and eventually to share their magnificent reward. To make this more practical, the Church has designated certain saints as the "patron saints" of a vocation, career or trade. Other saints have received this honor as the result of popular acclaim. There are some cases where the reason for such an honor is very evident, while other patron saints are selected without any apparent claim to this honor.

The patron saints that are listed in this paper are not taken from one source. On the contrary every available source was checked. It is quite evident that some saints receive more public veneration than others.

The title "patron saint" is given to a saint to whom special devotion is paid by the faithful in a particular place; one whose aid is sought in special needs; one whose name is received at Baptism, Confirmation, or in religion.

Patron Saint of the Natural Sciences

St. Albert the Great, 1206–1280. A Swabian by descent, Albert was sent to the University of Padua where he joined the Dominicans. Appointed lector of theology, he taught at Cologne and Paris. St. Thomas Aquinas was his disciple. St. Albert served as provincial of his Order in Germany, then as Bishop of Ratisbon. After two years he retired to Cologne, where he spent the rest of his life writing and teaching. Albert was the chief pioneer in the application of

the Aristotelian system to theology. His writings cover all branches of learning, hence he is called "the Great" and "The Universal Doctor." He was beatified in 1622 and was equivalently canonized by being declared a Doctor of the Church in 1931.

The honor of being the universal patron of all scientists is attributed to his writings which covered such divergent fields as astronomy, physics, botany, zoology, architecture, agriculture, climatology and phrenology.

His feast is celebrated November 15. He was appointed special *patron of scientists by Pope Pius XII, in 1941.*

Patron Saints of Physics

St. Ferdinand III, King of Castile, 1198–1252. A Spaniard by birth, Ferdinand became King of Castile in 1217, and of Leon in 1230. For twenty-seven years he was engaged in an almost uninterrupted crusade against the Mohammedans in Spain from whom he recaptured Cordova, Murcia, Jaen, Cadiz and Seville. He was founder of the University of Salamanca and of the Cathedral of Burgos. He was canonized in 1867 by Pope Pius IX.

He was honored with the title *Patron of Physics* as an acknowledgment of his research work in electricity and magnetism. His feast is celebrated on May 30.

St. Michael the Archangel appeared to the Bishop of Siponto in 492 and admonished him to build a church in his honor on Mount Gargano in Apulia, which later became the kingdom of Naples. The history of the apparition is related in the chronicle of Sigebert and handed down by ancient tradition.

This feast is celebrated on May 8. St. Michael was appointed special *patron of radiologists and radio activity as well as radium-therapists.*

Roger Bacon, O.F.M., 1214–1294, was a scientist of English birth. He studied in Paris and became a Franciscan. He stressed the scientific method in opposition to the traditional scholasticism and was the center of controversy for many years. He took special pains in applying the sciences to Holy Scripture and the dogmas of faith. His teachings were so far in advance of his times that he was imprisoned for about fifteen years. He had a profound knowledge of the Arabic philosophy. The aim of his philosophical works was to make Christian philosophy acquainted with the Arabic

philosophers. He was not an enemy of true philosophy, but he aimed to show the relationship between theology and philosophy. He showed the highest veneration toward the Fathers of the Church. Bacon was a great scholar of open character who frankly uttered what he thought, who was not afraid to blame whatsoever or whomsoever he believed deserved a censure. His iron will surmounted all difficulties and enabled him to acquire a knowledge so far surpassing the average science of his age, that he must be reckoned among the most eminent scholars of all times. Many of his writings were put in circulation under the names of other scholars. Other treatises still lie in the dust of great European libraries, especially of England, France and Italy. In his last scientific confession of faith he set forth the ideas and principles which animated him during his long life; he had nothing to revoke, nothing to change. This work was first published by the British Society of Franciscan Studies, III, at Aberdeen, in 1911.

Although I failed to find his name listed among the canonized saints, his name may be found in *Christian Conversation, Catholic Thought for Every Day of the Year,* edited by Anne Freemantle. March 5 is the day set aside in his honor. He is the special patron of scientists who use the telescope and microscope.

Patron Saints of Chemistry and Chemists

Saints Cosmas and Damian, Martyrs, died about 303 A.D. These twin brothers were Arabian physicians, converts to the faith, who healed souls as well as bodies in Asia Minor communities, and would take no payment for their services. They were tortured and beheaded during the Diocletian persecution. They are mentioned in the Canon of the Roman Mass.

The honor of being the patron of all professional people whose employment calls for a knowledge and application of chemistry is attributed to the numerous cures obtained through their intercession and their charity in caring for the sick. Their feast is celebrated on September 27.

Patron Saints of Astronomy and Astronomers

Saint Dominic Guzman, Confessor, 1170–1221, was the founder of the Order of Preachers, popularly called Dominicans. St. Dominic

was born in Castile, Spain, but was sent to the schools of Palencia, and then to Salamanca. With the permission of Pope Innocent III, he preached the Gospel among the heretics. To provide for the education of the children, he established a convent of nuns at Prouille, which became the nucleus of the Order of the Dominican nuns. The rule was approved by Pope Honorius III in 1216. His eloquent preaching and holiness of life converted some 100,000 unbelievers, especially among the Albigensian heretics in southern France. In response to Our Lady's instructions he spread the Rosary devotion everywhere. St. Dominic died in 1221, at Bologna, and was canonized in 1234.

St. Dominic urged upon his brethren the necessity of study, "whether on journeys, at home, by day or night." He succeeded so well that half a century after his time the Dominicans possessed about seven hundred doctors in theology, whereas in 1220, there were not twenty-five to be found in Europe.

He is honored as the *patron of astronomers* which may be attributed to the visions he had.

The Wise Men from the East, Casper, Melchior, and Balthasar from Arabia, Chaldea or Persia, devoted much of their time to the study of astronomy. When the mysterious star appeared, these learned men recognized it as a sign that the coming of the Messias was at hand and that He would be born in Judea. Following the star they reached Bethlehem.

From the fourth century on, the Greeks commemorated at this feast the baptism of Our Savior, when it was revealed that He was the Son of God, and the marriage of Cana, when Jesus for the first time publicly manifested His miraculous power. The Latins recall in addition upon this day the appearance of the star in the East and the journey of the Magi to Bethlehem. Names were attributed to them as early as the eighth century. Their feast is celebrated on January 6.

Although these Wise Men have not been declared special patron saints by the Church, they possibly deserve that honor for their obedience in following the star that led them to Christ.

Patron Saints of Physiography and Geographers

St. Bernard of Menthon was a Canon regular of St. Augustine. For forty years he served the Bishop of Aosta as vicar-general of

the diocese, visiting every mountain and valley in the Alps, and taking particular care of travelers. For this purpose he founded two hospices on the Alpine passes. He died at Novara in 1081. St. Bernard was named *patron of mountain climbers* by Pius XI in 1923. His feast is celebrated in the Church on May 28.

St. Barbara, Virgin and Martyr, dedicated herself to Christ. She was put to death by her own father, whereupon he was struck by lightning. The place and date of her death are uncertain, but she suffered martyrdom about 235 or 238 A.D. Her feast is celebrated on December 4.

St. Barbara is honored as *the patroness of firemen, firework makers, artillery men, architects, smelters, saltpetre workers, brewers, armourers, hatters, tilers, masons, carpenters and mathematicians, and is also invoked against lightning, sudden death, and final impenitence.*

St. Emidius, Bishop and Martyr, is said to have been a Teuton who came to Rome and was sent to preach in the Marches of Ancona, of which region he was consecrated bishop. He was put to death with three companions, at Ascoli under Diocletian, in 303 A.D. His feast is celebrated August 5. St. Emidius is invoked against *earthquakes.*

St. Florian was a high Roman officer in Noricum, now Upper Austria, who was condemned to death for his zeal. He was drowned in the Enns, near Lorch (Norcia) in 304. His feast is celebrated May 4.

St. Florian has been named the *special patron of firemen and protector against fires.*

St. Catherine of Siena, 1347–1380, was born at Siena in Tuscany, the twenty-fifth child of a wool-dyer. She received the habit of the third order of St. Dominic at the age of sixteen but continued to live at home. She worked among the poor and was very successful in converting sinners. Her interest in the affairs of the Church prompted her to advise Pope Gregory IX to abandon Avignon and return to Rome. She was loyal to Pope Urban VI and obeyed when he summoned her to Rome. She died still fighting in the cause of the true pope. Her four hundred letters and the "Dialogue" give evidence that she was a mystic. She was canonized in 1461 and declared patron saint of Italy in 1939. Her feast is celebrated April 30.

St. Catherine has been named as the *special patron to invoke against fires.*

St. Anthony of Padua, Confessor and Doctor of the Church, 1195–1231, was a native of Lisbon. He entered the Order of Canons Regular of St. Augustine and remained in the Order ten years, intent on his studies. When the relics of five Franciscan martyrs were brought from Morocco to Portugal, he decided to follow in their footsteps. His brethren offered extreme opposition, but he finally obtained the consent of the prior and passed over to the Franciscan Order.

St. Anthony was unsuccessful in his attempt to reach Africa, but God provided an opportunity for him to see St. Francis who assigned him the office of teaching theology to the brethren, provided the spirit of prayer and devotion is not extinguished. He was an accomplished orator and filled with zeal for souls. His feast is celebrated June 13.

St. Anthony is the patron saint of the poor and of travelers. He is particularly invoked in dangers of shipwreck. Pope Leo XIII called him "The Saint of the whole world." Pope Pius XII conferred the title "Doctor of the Church" on our great Franciscan saint.

St. Columban, Abbot, Confessor, 545–615 A.D. This Irish monk preached the faith in Britain and Gaul and founded the monastery of Luxeuil which he governed for twenty-five years. He ended his days in exile in Northern Italy. He exerted a determining and lasting influence on the civilization of Western Europe. His feast is celebrated on November 21.

St. Columban has been named the *patron saint to invoke against floods.*

St. Hermenegild, Martyr, died 586 A.D. He was brought up as an Arian at the Visigoth Court of Toledo, Spain, but was converted to Catholicism by St. Leander, Archbishop of Seville, and married a Catholic princess of the Franks. Captured by his irate Arian father after he had taken up arms against him, he refused Communion from an Arian bishop and was beheaded. His feast is celebrated April 13.

The Church has appointed St. Hermenegild *patron against storms, drought, and floods.*

St. John the Apostle and Evangelist died about 104 A.D. A younger brother of St. James the Greater, he seems to have been the most youthful of the Apostles, and the last of them to die. He was with Mary at the foot of the Cross when Jesus died, and it was into his care that the Blessed Virgin was entrusted by her Divine Son. St. John governed "the seven Churches" of Asia Minor. He wrote the Apocalypse which gives a report of the visions he had. His feast is celebrated December 27.

St. John the Apostle and Evangelist has been named the *special patron against lightning, rain, hail and pestilence.*

St. Odo, 879–942, was born in Maine, and educated at the cathedral school of St. Martin of Tours. In 909 he became a Benedictine at Baume under Bl. Bruno, and later succeeded him as abbot. His influence was exerted throughout France and Italy, including Rome. Popes had recourse to him in their difficulties; princes appealed to him to reform monasteries in their domain. He was one of the great abbots that enhanced the prestige of the Benedictine Order. In the summer of 942, when he was in Rome, Odo was attacked by malaria. He was returned to Tours where he died November 18. His feast is commemorated on this day. St. Odo is prayed to for *rain.*

St. Scholastica, 480–543, was the twin sister of St. Benedict. He became a monk at Monte Cassino and she became a nun under his direction at Liris. Once a year they spent a day together at the guest house of the abbey. St. Gregory narrates that, at her last meeting with her brother, she obtained by prayer a sudden heavy rainstorm, which prevented Benedict from returning to his monastery and thus prolonged their interview through the night. Three days later Benedict saw her soul ascend to heaven in the form of a dove. Her feast is celebrated on February 10. St. Scholastica is *invoked against storms.*

St. Sebaldus died 770 A.D. This saint was the son of a Danish king, who became a missionary monk of the Benedictine Order in Reichsbald, Bavaria. He worked with St. Willibald and St. Boniface in the evangelization of Germany, and died a hermit in the Nuremberg country about 760. His feast is celebrated August 19. St. Sebaldus is the patron saint of Nuremberg. St. Sebaldus is invoked by the Church *against cold.*

Patron Saints of Geology and Geologists

St. Maurus, Abbot and Confessor, died about 580 A.D. Maurus was placed under the guidance of St. Benedict, the patriarch of Western Monks, then at Subiaco. The youth grew up a faithful disciple of St. Benedict and a pattern of obedience to his fellow monks. When Benedict migrated to Monte Cassino he left Maurus in charge of the monasteries in Subiaco. His feast is January 15. St. Maurus has long been honored as the *patron saint of coppersmiths.*

St. Luke, Evangelist, First Century. St. Luke is the only evangelist who was not a Jew. He was a native of Antioch; his mother tongue was Greek, and he used it with an elegant simplicity. He was a close friend and companion of St. Paul, and even accompanied him to Jerusalem from whence Paul was taken prisoner. He remained with him until his martyrdom.

St. Luke is the author of the third Gospel. He preserved for us the parables of the lost sheep, the prodigal son, the Pharisee and the Publican, and Dives and Lazarus; the prayer of the Crucified for His executioners; the promise to the good thief. Dante calls him "Historian of the compassion of Christ." There is no evidence that he died a martyr. His feast is celebrated October 18. St. Luke is the *patron saint of doctors, painters, glassmakers, of artists in general,* and *particularly those who use color and brush.*

St. Dunstan, Bishop, 910–988. This man was one of the great figures in English history—abbot, archbishop, statesman, saint. An Anglo-Saxon by origin, he became a monk. In 943, he was made abbot, and under his rule the monastery became the greatest center of learning in England. He himself excelled as a goldsmith, illuminator and musician. He was chief adviser to King Edgar, and Pope John XII appointed him papal legate to England. He achieved a complete monastic reform in England and initiated uniformity. Active and energetic to the end, he died peacefully at Canterbury, in his Cathedral of Christ Church. His feast is celebrated May 19. St. Dunstan has been declared *patron saint of goldsmiths.*

St. Anastasius the Fuller, Martyr, died 304. This saint was a fuller not far from Venice. He crossed into Dalmatia and continued to ply his trade at Salona and to profess his religion openly, painting a conspicuous cross on his door. He was seized and drowned. His

feast is celebrated September 7. St. Anastasius is also recognized as the *patron saint of goldsmiths.*

St. Eligius, Bishop, 588–660 A.D. A native of Limoges, he became a very skillful metalsmith, and was appointed master of the mint at Paris under King Clotaire II. In 640, he abandoned this office to become a priest and soon after was consecrated Bishop of Noyon. He evangelized the districts of Antwerp, Ghent and Courtrai, founded the Solignac Abbey and other monasteries and convents. He was one of the most lovable and popular saints of the Middle Ages. His feast is celebrated on December 1. The Church has declared him the *patron saint of metalworkers, blacksmiths, miners, locksmiths, clockmakers, toolmakers and carriage makers.*

St. Clement, Pope, Martyr, died 100 A.D. This saint was a Roman by birth, who owed his conversion from the Jewish faith to Sts. Peter and Paul. He accompanied St. Paul to Rome and was consecrated Bishop by St. Peter. He became the third pope about the year 91. He wrote two Epistles which have been given rank next to the canonical books. He is believed to have suffered martyrdom at the age of 100 years. His feast is commemorated in the Church on November 23, and he is mentioned in the Canon of the Mass. St. Clement has been declared *patron of marbleworkers and stone cutters.*

The Four Crowned Martyrs were given this collective title because their names were first unknown. They are Claudius, Nicostratus, Symphorianus, Castor and Simplicius that have been authentically established. A basilica was erected in their honor on the Caelian Hill in medieval times. It is a stational church during the season of Lent. Their feast is commemorated in the Church on November 8. The Four Crowned Martyrs have been taken as *patrons by masons, sculptors and stoneworkers.*

St. Andronicus, Martyr, died 304 A.D. His feast is celebrated on October 11. St. Andronicus has been given the title *patron of silversmiths.*

St. Stephen the Deacon, First Martyr, died 33 A.D. The disciple chosen by the apostles was the first of the seven deacons. He was stoned to death by the Jews at the instigation of the Sanhedrin who accused him of blasphemy against God and Moses. Kneeling down he prayed for his murderers. His dying prayer obtained the conver-

sion of St. Paul, who was actively engaged in his martyrdom. The finding of his relics is commemorated on August 3, but his feast is celebrated on December 26. St. Stephen has been declared the *patron of stonemasons and smelters.*

St. Leonard of Reresby, 13th century. This saint was a native of Thryberg in Yorkshire. He was a crusader, who, taken prisoner by the Saracens, was miraculously set free and returned safely home. His feast is celebrated November 6. St. Leonard is the *patron saint of prisoners, coppersmiths, blacksmiths, locksmiths, porters, coal miners and coopers.*

St. Vincent Ferrer, 1350–1418, was a celebrated preacher and Dominican, and a miracle worker, born at Valencia, Spain, January 23, 1350. He traversed Spain, Italy, Switzerland and France "like an angel flying in the midst of the sky," says Pius II in the bull of canonization, "spreading the words of salvation and showing that the day of judgment is near." He died at Vannes in Brittany, April 5, 1419. His feast is celebrated on April 5, the day of his death. The Church has given St. Vincent the title *"patron of makers of tile and brick, pavement workers and plumbers."*

Patron Saint of Anatomy and Anatomists

St. Pantaleon, Martyr, died 305 A.D. He was a famous physician at the court of Emperor Maximianus at Nicomedia, and was martyred for the faith under Diocletian. A phial containing some of his blood liquefies each year on his feast day in the cathedral of Amalfi in southern Italy. He was one of the fourteen Holy Helpers and the *patron saint of physicians.* His feast is celebrated on July 27.

Patron Saints of Physiology and Physiologists

St. Blaise, Bishop, Martyr, died about 320 A.D. A physician by profession, he was made Bishop of Sebaste in Armenia because of his outstanding virtues. St. Blaise cured both men and animals of their ailments. He is one of the fourteen Holy Helpers in Need and a Patron of Physicians. His feast is celebrated on February 3. Since he saved a boy's life by extricating a fishbone from his throat, the Church has incorporated into the Roman Ritual *The Blessing of*

Throats on his feast. St Blaise has thus been declared by the Church the *patron of throat diseases.*

St. Erasmus, Bishop, Martyr, died about 303 A.D., is supposed to have been martyred in Campania. He is represented with his abdomen torn open, tortured by executioners winding his intestines on a windlass. This has caused his invocation for *intestinal* maladies. His feast is celebrated on June 2.

St. Lucy, Virgin, Martyr, 283–304. A Sicilian maiden who suffered martyrdom under Diocletian. She is one of the most famous of the Western virgin-martyrs, and is still commemorated in the canon of the Mass. Her feast is on December 13. St. Lucy is invoked as the *patroness of eye trouble.* She is represented with eyes on a plate.

St. Ottilia, Virgin, 660–720, was born blind and cast out for this reason by her family. She was adopted by a convent, and instructed in the Catholic religion. When she was baptized, she miraculously regained her sight. She founded a Community of which she was abbess. Her feast is celebrated December 13. St. Ottilia is invoked by the Church as the *patroness of the blind.* She is represented with eyes on a book.

St. Catherine of Alexandria, Virgin, Martyr, died 310 A.D. A maiden martyred at Alexandria under Maximinus. She argued with fifty philosophers before she was put to death by means of an engine fitted with a spiked wheel. She is considered the *patroness of women students, teachers and philosophers,* and is invoked in tongue ailments. Her feast is commemorated on November 25, and with the fourteen Holy Helpers.

St. Raymond Nonnatus, Confessor, 1200–1240 A.D. He joined the newly founded Mercedarians in response to a vision of Our Lady, and was made their Master General after the death of St. Peter Nolasco. While imprisoned in Algeria as a hostage pending the ransom for certain Christians, he tried to convert the Mohammedans and had his lips padlocked together as the result. He died shortly after his return to Spain. His feast is commemorated on August 31. St. Raymond has been named *patron of pregnant women.*

St. Gerard Majella, Confessor, 1726–1755. He was a Redemptorist lay brother, famed for his extraordinary supernatural gifts of levitation, invisibility and bilocation. He could even obey unspoken mental orders given by his superiors at great distances. His prayers

and ardent devotion to the Blessed Sacrament converted many sinners. His feast is commemorated by the Church on October 16. St. Gerard Majella is considered the *patron of mothers.*

St. Aloysius, Confessor, 1368–1391. This young Jesuit was outstanding in his studies, his perfect obedience and his intense life prayer. He is the *patron saint of youth.* It may be well to mention that St. Aloysius was a member of the Third Order of Saint Francis. He fell sick while nursing the plague stricken and died. He was beatified in 1605 and canonized in 1726. Benedict XIII declared him special protector of young students and *Pius XI proclaimed him patron of christian youth.* He is also known as the *patron invoked by patients suffering from sore eyes and pestilence.*

St. Andrew the Apostle and Martyr, died 60 A.D. He was St. Peter's elder brother, the first Apostle chosen by Our Lord. He preached in Asia Minor and was martyred in Greece. His name occurs in the Canon of the Mass. St. Andrew's feast is celebrated on November 30. St. Andrew is the patron saint of Scotland, Russia and Greece, but he is also known as the patron to be invoked by all who want to be preserved from or cured of *gout and sore throat.*

St. Andrew Avellino, Confessor, 1521–1608, was a lawyer in southern Italy. He gave up his profession to become a Theatine and greatly furthered the spread of his community. God blessed his work and also granted him the gift of miracles. *He is invoked against sudden death since he died of a stroke at the foot of the altar.* His feast is celebrated in the Church on November 10.

St. Peregrinus Laziosi, 1260–1345, was a native of Forli who spent a very worldly youth. During a revolt he struck St. Philip Benizi across the face. Philip turned the other cheek to him and Peregrinus was converted. He became a holy member of the Servite order. He was instantaneously cured of cancer of the foot as the result of a vision, and is for this reason called the *patron saint of all cancer patients.* His feast is May 1.

St. Servulus, died 590 A.D., was a lifelong paralytic who begged at the door of the St. Clement's Church in Rome. He passed to his reward while the angels sang around him. His feast is celebrated December 23. He has been declared the *patron saint of the paralytics.*

St. Teresa of Avila, Virgin, 1515–1582, was a Carmelite nun, founded new convents of the austere, primitive rule, in accord with the instructions of Our Lord. She was one of the Church's great mystics. "Her Way of Perfection" and "Conceptions of the Love of God" are well known books. She is the *patron saint of Spain and of all who suffer from headaches.* Her feast is commemorated on October 15.

St. Victor of Marseilles, Martyr, 304 A.D. Victor suffered martyrdom with three prison guards whom he converted. He was crushed under a millstone on the public threshing floor, "like the wheat chosen of God." His feast is commemorated on July 21. St. Victor is known as the *patron saint of all who suffer from foot diseases.*

St. Timothy, Bishop, Martyr, 32–97 A.D. was St. Paul's friend and companion on his missionary journeys through Asia Minor and Greece. He was killed by a pagan mob when he protested against their festivities in honor of Diana. His feast is commemorated in the Church on January 24. He is honored in the Church as the *patron saint of all who suffer from stomach ailments.*

St. Vitus, Martyr, 303 A.D. is one of the Fourteen Holy Helpers and is invoked by the Church as the *patron saint against epilepsy and nervous disorders.* His feast is commemorated in the Church on June 15.

Patron Saints of Botany and Botanists

St. Dorothy, Virgin, Martyr, died 311 A.D. She is the *patron saint of gardeners and florists.* Her feast is celebrated February 6.

St. Fiacre, died 670 A.D., was of Irish or Scottish origin. He lived in the forest of Breuil, and divided his time between prayer, the work of his hands, and the care of the poor. He is known as the *patron saint of hosiers and gardeners.* His feast is celebrated August 30.

St. Isidore the Farmer, Confessor, died 1170 A.D. This saint was a native of Madrid, who spent his whole life working in the fields on an estate just outside the city. He was married to St. Mary de la Cabeza. He was canonized in 1622 and is venerated as the *patron saint of Madrid and also of farmers.* His feast is celebrated on May 10.

Patron Saints of Zoology and Zoologists

St. Anthony the Great, Abbot, Confessor, 251–356 A.D. He organized thousands of disciples who followed him into the desert and gave these hermit-monks the rule by which they lived in individual cells but came together for religious services. His feast is celebrated on January 17. St. Anthony has been named the *patron saint of domestic animals.*

St. Ambrose, Bishop, Confessor, Father and Doctor of the Church, 340–397 A.D. Ambrose, the Consular Governor of northern Italy, beloved for his kindness and justice, was elected Archbishop of Milan. He undertook a study of the Scriptures and the Greek and Roman Fathers, and soon became a great preacher and a prolific writer on Christian topics. His feast is celebrated December 7. St. Ambrose is known as the *protector of bees and domestic animals.*

St. Andrew the Apostle, brother of St. Peter, is the *patron saint of fishermen and fish dealers.* His feast is commemorated November 30.

St. Anthony of Padua is invoked for the *protection of asses and horses.* This great Franciscan's feast is commemorated on June 13.

The Assumption of the Blessed Virgin is the *feast of harness-makers and fish dealers.* This feast is celebrated on August 15.

St. Bartholomew the Apostle is the *patron saint of butchers.* His feast is August 24.

St. Blaise is invoked *against wild beasts.* His feast is February 3.

St. Cuthbert is the *patron in England of shepherds.* His feast is March 20.

St. Dominic of Sora is invoked against *fever and snakebites.* His feast is January 22.

St. Eligius is the patron saint of veterinarians and is invoked for *the cure of sick horses.* His feast is December 1.

St. Gomer is the *patron saint of cowherds.* His feast is celebrated October 11.

St. Hilary is *invoked against snakes.* His feast is January 14.

St. Guy or Vitus is *invoked for dogs and against rabies.* His feast is June 15.

St. Hubert is the *patron saint of hunters.* He is *invoked against rabies and for the protection of dogs.* His feast is November 3.

St. John the Baptist is the *patron saint of bird dealers;* also prayed to for the *protection of lambs.* His feast is June 24.

St. Julian is the *patron saint of shepherds.* His feast is February 12.

St. Martin is the *patron saint of horsemen,* and is *invoked for the protection of geese.* His feast is November 11.

Blessed Martin de Porres is the *patron saint of mulattoes* and is *invoked against rats.* His feast is November 3.

St. Paul, *patron of ropemakers,* is *invoked against serpent bites.* His feast is commemorated with that of St. Peter, but his special feast is June 30.

St. Roch is *invoked against cattle diseases.* His feast is August 16.

St. Servatus is *invoked against rats and mice.* His feast is February 1.

The Transfiguration of Our Lord is the *feast of pork butchers and cleaners.* This feast is celebrated on August 6.

Patron Saints of Anthropology and Anthropologists

St. Augustine of Hippo, Bishop, Confessor, Father and Doctor of the Church, 354–430 A.D. After his conversion from Manichaeism by St. Ambrose of Milan, St. Augustine refuted many heretical beliefs which were current, among them the false opinions of the origin of man. His feast is celebrated on August 28. St. Augustine is the patron saint of theologians and printers, but we might rightly call him the *patron saint of anthropologists.*

Patron Saints of the Medical Sciences and Scientists

St. Francis of Assisi was the exemplification of the ideal based upon the charity that Christ taught His followers. The followers of St. Francis must imitate his warm, simple and sincere concern for the lepers. St. Clare and her community, St. Elizabeth of Hungary, and St. Louis IX of France reflected the Franciscan interpretation of the basic ideal of charity to God's sick and suffering creatures. These great Franciscans are the *patrons of religious communities that devote themselves wholeheartedly to the service of the sick and unfortunate.*

St. Vincent de Paul, 1576–1660, was the founder of three organiza-

tions or "armies of charity." He founded the Ladies of Charity in 1617, the Priests of the Mission (Vincentians) in 1625, and the Daughters of Charity in 1633. The two women's organizations have as their immediate object the care of the sick. He entrusted the technical instruction and spiritual formation of the nurses to St. Louise de Marillac. The Sisters were actively engaged in the nursing of the poor persons in their homes, but they also accepted the administration of the Hotel Dieu in Paris. From the nursing in general hospitals, they branched out to special ones: for the foundlings, the aged, the mentally ill and the wounded soldiers. St. Vincent de Paul's feast is July 19. The feast of St. Louise is March 15. St. Vincent de Paul is the *patron of all charitable societies,* so named by Pope Leo XIII on May 1, 1885.

St. John of God, 1495–1550, was born in Portugal. In 1538 he established his initial foundation for the care of the physically and mentally sick. Innovations introduced by John of God included a bed for each patient, proper diet, adequate ventilation, classification of the sick by their illness, a program of specialization in hospital care prescribing a regime of cleanliness for the sick. John of God was a promoter of organized hospital care. His followers, the Hospitaller Brothers of St. John of God, have 200 houses scattered throughout the world, and are traditionally the nurses of the Holy Father. On June 22, 1886, Pope Leo XIII declared St. John of God the *patron of Catholic hospitals and the sick, of religious and lay nurses of both sexes.* His feast is March 8.

St. Camillus de Lellis, 1550–1614, was born at Bucchianico, Italy. This soldier of fortune became a model of heroic virtue and a great saint. He introduced the use of the Red Cross insignia as a sign of organized charity; the use of field ambulances in time of war, and recognized the need of professional nurses to care for the sick. St. Camillus founded an Order of Priests and Brothers, wearing a black habit with a red cross, to devote themselves to the care of the sick and dying, even those stricken with pestilence. St. Camillus saw Christ in every sufferer. His feast is July 18. Pope Leo XIII declared St. Camillus the *patron of Catholic hospitals and the sick, of lay and religious nurses of both sexes,* on June 22, 1886.

St. Luke was a remarkable combination of physician, historian

and evangelist. He had an extensive academic and scientific background, could speak several languages, was a physician by profession, and the author of the Third Gospel. St. Paul called his young friend "the beloved physician." St. Jerome says that "Luke, the physician, by leaving to the Church his Gospel and Acts of the Apostles, has shown us how the Apostles became from fishers of fish, fishers of men; for he himself became from a physician of the body, a physician of the soul." His feast is celebrated on October 18. St. Luke has been declared the *patron of Catholic physicians.*

St. Apollonia, Virgin, Martyr, died about 249 A.D. This holy deaconess had her teeth knocked out by a frenzied pagan mob in Alexandria and was then burned at the stake. Before dentistry came to be known as a science and a profession, sufferers from dental illnesses prayed to St. Apollonia for relief. She is the *patron of dentists.* Her feast is celebrated on February 9.

Sts. Cosmas and Damian, Martyrs, died about 303 A.D. These twin brothers were Arabian physicians, converts to the faith, who healed souls as well as bodies in Asia Minor communities. They would take no pay for their work. They were tortured and beheaded during the Diocletian persecution. Their feast is September 27. *Physicians and druggists* look upon them as their patrons. The twin brothers symbolize the early recognition of the unity as well as the division of labor and responsibility between the two professions of healing—their interdependence.

St. Pantaleon, Martyr, died about 305 A.D. He was a famous physician at the court of Emperor Maximianus at Nicomedia, and was martyred for the faith under Diocletian. A phial containing some of his blood liquefies each year on his feast day in the cathedral at Amalfi in southern Italy. He is one of the fourteen Holy Helpers, the *patron saint of physicians.* His feast is July 27.

St. Raphael the Archangel is thought to have stirred the waters in the Probatic Pool, hence he is considered the *patron of the sick people and their nurses.* His feast is October 24.

St. Catherine of Siena, 1347–1380, was a Dominician Tertiary, who was favored by God with extraordinary graces. St. Catherine personally assisted the poor, served the sick and comforted the afflicted and prisoners. Humility, obedience and denial of her own will gave them true value. The ardent charity of this holy virgin

made her indefatigable in her labors for the conversion of sinners. She also contributed much to the reform of the Church under Pope Gregory XI and Pope Urban VI. Pope Pius XII named St. Catherine of Siena *patron of Italian nurses.* The Catholic Hospital Association of the United States and Canada selected her as *patron of nurses and nursing service.* Her feast is April 30.

St. Elizabeth of Hungary, 1207–1231, was a saint, queen and tertiary of St. Francis of Assisi. She was noted for her kindness to the poor and distressed. She built several hospitals where she spent many hours serving the sick and dressing their wounds. Her husband, Louis IV, died while participating in the Crusade. After his death, Elizabeth was forced to take her three small children and flee from the palace because of persecution of her brother-in-law. In spite of these sufferings and privations, she continued to spend much of her time caring for the sick and the poor. She died in 1231 at the age of twenty-four. She was canonized in 1235. St. Elizabeth has been chosen *patron of nurses and nursing service* by members of the profession and the Catholic Hospital Association. Her feast is November 19.

St. Basil the Great, Bishop, Confessor, Father and Doctor of the Church, 329–379 A.D., is called "The Father of Eastern Monasticism" because he composed the "Rule of St. Basil" which combined manual labor, study and prayer for his monks. Basil was proficient in all liberal arts and sciences, but especially excelled in oratory, literature and philosophy. After also learning the general principles of geometry, medicine and other sciences, he devoted himself solely to religion. Basil built a vast hospital for the sick, the poor, the travelers, the aged, the orphans, and others needing assistance. He visited the sick and consoled and instructed the patients. He spared no pains and feared no danger in rescuing his flock from spiritual evils and bodily misery. His feast is June 14. St. Basil has been selected as the *patron of hospital administrators.*

St. Frances Xavier Cabrini, 1850–1917, was the foundress of the Missionary Sisters of the Sacred Heart and an organizer of hospitals in this country especially for the Italians. The first hospital established by her was Columbus Hospital in 1892, 400 years after the discovery of America and was named in his honor. In addition to

the hospitals, she established schools, orphanages and hospitals in Central and South America. Hers was a fruitful life. She was canonized by Pope Pius XII on July 7, 1946. Her feast is December 22. St. Frances Xavier Cabrini has been selected as the *patron of hospital administrators.*

St. Gemma Galgani, 1878–1903, was the daughter of a pharmacist. She suffered grievously from sickness and surgical operations; far greater were her spiritual and mental trials. She nursed the members of her own family when they were sick. Through her intercession many have been cured of physical and spiritual ills. She was favored with the stigmata of the hands, feet and side. Soon she was favored with mystical scourging, crowning with thorns and the wound of the shoulder. St. Gemma was canonized by Pope Pius XII on May 2, 1940, and appointed *patron of pharmacists.* Her feast is April 16.

St. Martha was the sister of Lazarus and Mary of Bethany. She frequently invited Jesus to her home and served Him food that she had prepared. He praised Mary's prayerful contemplation but He did not reprehend Martha. All she did was for love of Him. St. Martha is the *patron of dietitians and dietary services.* Her feast is July 29.

St. Albert the Great lived in the golden age of learning in the company of Thomas Aquinas, Bonaventure, Innocent III and others. Albert was a renowned philosopher, a celebrated theologian, and had a profound knowledge of physics, biology, minerology, chemistry, zoology, physiology and related sciences. Albert brought to light the works of Aristotle and preserved them for future generations. He verified by experiment the findings of others in the field of science and enlarged upon them. St. Albert has been chosen the *patron of medical technologists.* His feast is November 15.

St. Peter, Apostle, Martyr, was chosen to be the Keeper of the Keys of the Kingdom. In molding him, Christ treated him with gentleness, tempered him with severity, and unflagging patience. He spoke, made decisions, and acted as master of every situation, trusting that Jesus Christ would protect and guide him. The medical record librarian's role as "keeper of the keys" to the confidential documents should have deep devotion to the "Keeper of the Keys" of the Kingdom of Christ.

The medical record librarian enjoys the special confidence of her administrator and the medical staff. She is in need of the same qualities in her dealings with the medical staff that Christ revealed to Peter. His feast is June 29. St. Peter has been selected as the *patron of medical record librarians.*

St. Rene Goupil, Confessor, Martyr, 1607–1642, was a Jesuit lay brother. He studied medicine, specializing in surgery. He was killed by an Indian for making the Sign of the Cross for an Indian child. St. Rene was canonized by Pius XI on June 29, 1930. His feast is celebrated with that of the Jesuit Martyrs of North America. St. Rene Goupil has been selected as the *patron of anesthetists.* His feast is September 26.

St. John Francis Regis, Confessor, 1597–1640, was a Jesuit priest who labored particularly among the poor farmers and lace-makers of southern France and was able to improve their marketing and labor conditions. His social service program included visitation of hospitals, giving assistance to the needy, preaching Catholic doctrine with tireless zeal to children and the poor. His feast is June 16. St. John Francis Regis has been selected as the *patron of medical social workers.*

St. Gabriel seems to be in a particular way the messenger of God to man. He foretold to Daniel the destruction of the Persian Empire by Alexander the Great (Daniel 8:16–25) and the coming of Christ after sixty-nine weeks of years (Daniel 9:21–27). He is the Archangel sent to Zachary (Luke 1:11–20) and especially to Our Lady, to tell her she was chosen to be the Mother of God (Luke 1:20–38). His feast is commemorated on March 24. St. Gabriel is the *patron saint of communications, telephone operators, telegraph operators, radio and television.*

St. Clare of Assisi, whose feast is August 12, is the *patroness of television.* In her honor Archbishop Montini of Milan recently blessed and dedicated a new electronic establishment at Sesto S. Giovanni.

St. Joseph of Cupertino, the Seraphic Confessor, was beatified by Pope Benedict XIV, in 1753; canonized by Pope Clement XIII, in 1767. He was named the *patron of aviators* by Pope Pius XII in 1944.

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FRANCISCAN EDUCATIONAL CONFERENCE

First Session

Tuesday, August 16, 7:30 P.M.

Very Rev. Fr. Owen Bennett, O.F.M.Conv., the host and Guardian at St. Anthony-on-the-Hudson, Rensselaer, N.Y., opened the thirty-sixth annual meeting of the FEC with prayer. Fr. Ignatius Brady, O.F.M., the president, then read the following letter sent by Very Rev. Francis M. Edic, O.F.M.Conv., Provincial of the Immaculate Conception Province:

My dear Confreres:

I deeply regret my inability personally to welcome the Franciscan Educational Conference to our Friary, St. Anthony on Hudson. A spoken message of greeting could better express the warmth of our welcome, the sincerity of the pledge of fraternal hospitality by the local Friars of St. Anthony on Hudson and Siena College, and my own genuine interest in the Conference and particularly in the sessions and topics of this year.

Seventeen years have passed since the F.E.C. last convened at Rensselaer. During that period the discoveries in the field of science have exerted great impact not only on the previously accepted principles of the physical sciences but also on the science and art of life. Only the eternal truths and principles remain unquestionable and unchanged. It is expedient and timely, therefore, that the educators of the Franciscan family collaborate in an evaluation of some of the scientific findings and theories of the present era, adapting these into a coherent pattern by their use as the woof intertwining with the warp of the eternally immutable truths.

I presume that a suggestion to the Conference will not be amiss. I recall informal discussions during the 1930 meeting concerning the formulation of a syllabus which would outline for our minor seminaries a natural science course complying with all high school and college requirements but pointed specifically to the future studies in both philosophy and theology. To my knowledge no such course has been submitted to and approved by the Conference for presentation to the Franciscan seminaries but the titles of several papers indicate that this may be discussed during the present meeting. May I express the hope that a competent committee give this question further study?

May Almighty God inspire and fructify the sessions and discussions of this thirty-sixth annual meeting of the Franciscan Educational Conference, rendering them conducive to the further glory of Holy Mother Church and

of our Seraphic Order under the loving tutelage of our Maternal Patroness, the Mother of God.

Sincerely and fraternally,
Fr. Francis M. Edic, O.F.M.Conv.
Minister Provincial

Following the reading of the letter, the president formally introduced the host, Fr. Owen, who greeted the delegates with these words: "We are most happy that you are here to share our meagre means and to permit us to enjoy the benefits of the conference. The surroundings, with the beautiful woods and the Hudson at our back, speak for themselves; both we and they invite you in our midst. The warmth of our welcome takes a cue from nature which has shown both warmth and comfort to us. May God through nature and supernature be kind and gracious to you in the coming meetings."

The president acknowledged the invitational remarks by thanking the host and praising the friars for the attractive decorations in the hall. The walls were covered with yellow drapes on which were strewn pinnated maple leaves together with black silhouettes of St. Francis depicting his love of nature. It was an ideal setting for the theme "Nature—The Mirror of God." The delegates were reminded that they would each be assessed $2.00 per day for their bed and board. The president called attention to the literature display in the rear paying a fine tribute to Brother Finbarr, O.S.F., for his excellent work in editing *The Franciscan Educational Directory* just off the press.

Two telegrams were in the hands of the chair and were read to the assembly: The first was from Washington.

Rev. Sebastian F. Miklas, O.F.M.Cap.
Rensselaer, N. Y.

As we anticipated in our conversation some months ago, the absence of Commissioners attending the Geneva Conference prevents me from delivering my message in person. My good wishes and prayers are with you and your associates.

Thomas E. Murray
Commissioner, U. S. Atomic Energy Commission.

The second from Carey, Ohio, from Fr. Basil, former Vice-President of the FEC.

Franciscan Educational Conference:
May 1955 Meeting be blessed with scholarly learning and fraternal good cheer,

Fr. Basil Heiser, O.F.M.Conv., Provincial

Letters, telegrams and inspirational words from the president set the stage for the reading of the first paper *Problems of the Atomic Age* prepared by Mr. Thomas E. Murray, Commissioner, U. S. Atomic Energy Commission. The paper was read by Fr. Ernest Latko, O.F.M., in the absence of Mr. Murray. The evening's program was rounded out by Fr. Owen Bennett's treatise on *Nature—The Mirror of God—Two Interpretations.* After a warm discussion led by Fr. Aidan Carr, O.F.M.Conv., the meeting adjourned with prayer.

Second Session

Wednesday, August 17, 9:00 A. M.

The descending gavel noised abroad the appointment of the following committees: *The Resolutions Committee:* Allan Wolter, O.F.M., Rheinhold Link, O.F.M., Kieran Quinn, O.F.M.Cap., Quintin Roohr, O.F.M.Conv., Aquinas Thomas, SA, Ambrose Burke, T.O.R.; the *Committee on Public Relations:* Irenaeus Herscher, O.F.M., Edgar Holden, O.F.M.Conv., Roch Raible, O.F.M.Cap., Sebastian Soklic, T.O.R., and Brother Finbar, O.S.F.

Plunging into the work of the day the delegates were spell-bound by the apostrophe to reverence in Leander Blumlein's (O.F.M.) masterpiece, *St. Francis's Attitude toward Creatures.* From the poetic to the philosophic was just one step taken by Kenneth Dougherty, S.A., in his discerning analysis *Judgments on Modern Philosophies of Science.* Between the readings of the above papers there was a slight intermission at which time the president announced that a group picture would be taken of the friars. The meeting concluded with the Vice-President, Fr. Aidan, reminding the delegates to pay their daily dues.

Third Session

Wednesday, 2:00 P. M.

The inner sanctum of science was entered by the delegates who were struck with amazement at the astronomical figures and intricate formulae of the three papers that were read, *viz.:*

The Technological Spirit of Our Age—Berard Tomasetti, O.F.M.-Cap.

Latest Findings of Science on the Age of the World—Quintin Roohr, O.F.M.Conv.

The Complexity of the Atom—Allan Wolter, O.F.M.

After this introduction into the realms of science, Fr. Aidan promised other realms by announcing engaging field trips to Rensselaer Polytechnic Institute, Siena College and other points of interest. The meeting was closed with prayer.

Fourth Session

Wednesday, 7:30 P. M.

Mounting the rostrum the president announced a change in the next afternoon's schedule of papers. A count was taken of the friars interested in the various field trips. Then Fr. Ignatius called the attention of the assembly to the Executive Board meeting which would be held on Thursday at 1:15 p. m. The intellectual fare for the evening included the two following papers:

Proofs of the Existence of God through Natural Sciences—Kieran Quinn, O.F.M.Cap.

Some Impacts of Modern Science on Morality—Matthew Herron, T.O.R.

A lot of scholarly fur flew as the philosophers, scientists and theologians each reviewed St. Thomas's proofs for God's existence from their respective professional vantage point. It was a valuable discussion that helped to explain, clarify and interpret the recent papal allocution on science. Fr. Ignatius called for adjournment as refreshments for the evening were ushered in.

Fifth Session

Thursday, August 18, 9:00 A. M.

After the customary opening prayer, Fr. Irenaeus invited the friars to have a free copy of the "Annual Science Studies of St. Bonaventure's." Fr. Victor Hermann, O.F.M., then read his paper, *The Place of Natural Sciences in Catholic General Education.* Usually there is only one victor in battle, but on this occasion there were two Victors, the second one, Fr. Victor Schoenberger, O.F.M.-Conv., presented a definite plan in his *A Suggested Course in Physical Science for the Minor Seminary.* The two papers stressing the educational approach to the subject of science proved most useful and serviceable to the teachers present. Through the courtesy of Fr. Reinhold Link, O.F.M., a brief and enthusiastic talk on *God through Nature* was given by Fr. Reinhold. This talk ended the morning session.

Sixth Session

Thursday, 3:00 P. M.

This session began an hour later to enable the friars to take their field trips. As the delegates reassembled, the president announced that the Library Section would meet at 7:00 P. M. Other groups to meet that evening were: The Executive Board, Resolutions Committee, Commission for Theological Synthesis and the Committee on Public Relations. Two papers were read and discussed at this afternoon session:

The Sciences in the Itinerarium of St. Bonaventure—Sebastian Soklich, T.O.R.

Science Clubs in a Catholic High School—Brother Louis, O.S.F.

The latter paper was read by Brother Leonard. Fr. Roch Raible, O.F.M.Cap., in his discussion on science clubs gave a detailed account of the Bird-banding Club at St. Fidelis Seminary, Herman, Penna. The friars were treated with the wisdom of Fr. Thomas Plassmann, O.F.M. who discussed the *Itinerarium.* As the session closed the assembly was nudged to look at the Franciscan Herald Press Publications in the rear of the hall.

Seventh Session

Friday, August 19, 9:00 A. M.

Before the reading of the two and final papers, Fr. President asked the delegates to remember Fr. Philotheus Boehner, O.F.M., recently deceased, in their prayers. The paper, *The Teaching of Biology,* prepared by Fr. Philotheus was read by Fr. Allan Wolters, O.F.M. At the conclusion of Fr. Philotheus' paper Fr. Ignatius, the president, recalled to the members the scholarly work done by Fr. Philotheus at the Franciscan Institute and his many contributions to the Franciscan Educational Conference. The last paper of the annual meeting was Fr. Ambrose Burke's (T.O.R.) *An Annotated Bibliography of Papal Pronouncements on Science.* Bibliographies are valuable tools and for this reason alone the friars were most grateful for Fr. Ambrose's work.

The business meeting was opened with the re-appointment of Fr. Thomas Plassmann, O.F.M., and Fr. Daniel Egan, T.O.R., to the F.E.C. Commission. The other Commissioners are: Fr. Donald Wiest, O.F.M.Cap., Brother Finbarr, O.S.F., Fr. Juniper Cummings, O.F.M.Conv., and Fr. Titus Cranny, S.A. The Commissioners are appointed for a term of three years.

The Library Committee Report was presented by Fr. Ambrose Burke, T.O.R. and the Report for the Commission for Theological Synthesis was made by Fr. Cyril Shircel, O.F.M. The Secretary requested the delegates to hand in their papers and discussions as soon as possible, preferably before leaving Rensselaer. The Treasurer, Fr. Irenaeus Herscher, O.F.M., submitted the following report:

Receipts		
Bank Deposits—August 24, 1955	$3,545.74	
Interest Received	38.47	
Contribution (Capuchin Prov. Detroit)	25.00	
		$3,609.21
Expenditures		
Payment for Vol. 34 and Monograph	$2,353.91	
Contribution to Fran. Ed. Directory	150.00	
Cost of printing programs & mailing	83.11	
		$2,587.02
Balance on Hand as of August 19, 1955		$1022.19

The Resolutions of the Thirty-sixth Annual Meeting were read by Allan Wolters, O.F.M., and accepted as read.

The topic for the next annual meeting was discussed. Prominent among the subjects was "Papal Directives for Religious Life Today." Marathon, Wis., California, Garrison, (Atonement Friars), and Christ the King Seminary at St. Bonaventure's submitted invitations as hosts for 1956. By acclamation the following slate of officers was re-elected:

Fr. Ignatius Brady, O.F.M.—*President*
Fr. Aidan Carr, O.F.M.Conv.—*Vice-President*
Fr. Sebastian Miklas, O.F.M.Cap.—*Secretary*
Fr. Irenaeus Herscher, O.F.M.—*Treasurer*

A word of thanks was tendered by the president to Fr. Owen and the local friars for their sacrifice and helpfulness in making the 1955 meeting possible and enjoyable. The president thanked the delegates for their participation, the officers, for their work, Brother Finbarr for editing the *Franciscan Education Directory* and the secretary for his perennial editing of the annual report. Then all the friars joyously and gratefully chanted the *Te Deum* singing the praises of God, man and nature, so befitting the theme of the 1955 meeting.

RESOLUTIONS
OF THE
FRANCISCAN EDUCATIONAL CONFERENCE

The Committee on Resolutions of the Thirty-sixth Annual Meeting of the Franciscan Educational Conference respectfully submits the following resolutions:

1. *Whereas,* the Franciscan family, the Holy Cross Province of the Friars Minor of Saxonia, Germany, the Franciscan Institute and St. Bonaventure University as well as the scientific and philosophical world have suffered a great loss in the death of Fr. Philotheus Boehner, O.F.M., biologist, philosopher and master of Seraphic ascetical theology, Director of the Franciscan Institute, *be it resolved* that the Conference express its prayerful sympathy to all affected by his death and acknowledge its own indebtedness to the deceased by dedicating the Conference report to this great Franciscan who saw so clearly in nature a mirror of God.

2. *Whereas,* the present flourishing condition of the Conference is due in great measure to the zeal, foresight, scholarship and ardent love for things Franciscan of the Very Rev. Urban Freund, O.F.M., one of the founders and first secretary and ardent promoter of this Conference, *be it resolved* that the F.E.C. express its sincere and abiding gratitude to the deceased and its prayerful sympathy to St. John Baptist Province of the Friars Minor which sustains the loss of this great Franciscan.

3. *Whereas* the keynote address of the Hon. Thomas A. Murray, Commissioner of the United States Atomic Energy Commission, so admirably supports the aims of this Conference, *be it resolved* that we commend the Commissioner's attitude and heartily endorse his emphasis on the need of counteracting materialistic trends and tendencies in science teaching and thinking by a positive spiritual perspective.

4. *Whereas,* in the light of certain papers of this Conference, discussion from the floor indicates some difficulties with the present status of science in the curricula of the Minor Seminaries of the member provinces, and indicates an evidently existing desire for formulating a syllabus which would outline a natural science course for our Seminaries both complying with requirements of high school and college but pointed specifically to the needs of the Franciscan priest, *be it resolved* that a committee be instituted to seriously study this problem in order to present recommendations to the next meeting of the F.E.C.

5. *Whereas,* the hospitality of the guardian and friars of the Franciscan friary at Rensselaer, N. Y., was simply and warmly extended to the conference for this meeting, and whereas, the guardian and friars of the Franciscan friary at Siena College did give such whole-hearted cooperation in caring for the further needs of the participating members, *be it resolved* that the conference hereby express its grateful appreciation to the members of both these splendid communities.

REPORT OF THE
LIBRARY SECTION, 1954–55

Chairman—Ambrose L. Burke, T.O.R., Spring Grove, Pennsylvania.
Vice-Chairman—Vincent Dieckmann, O.F.M., Oldenburg, Indiana.
Secretary-Treasurer—Donald Bilinski, O.F.M., Pulaski, Wisconsin.

Since the session of August 17, 1954 at Padua High School, Watkins Glen, New York, the Library Section has sponsored two meetings up to the time of the present conference.

Librarians gathered under the chairmanship of Sister M. Josepha, O.S.F., of Holy Family College, Manitowoc, Wisconsin, at Sacred Heart Academy, Buffalo, New York, November 26, 1954 at 1:30 P. M. in connection with the third national meeting of Franciscan Teaching Sisterhoods. Lawrence Craddock, O.F.M., professor of English literature at Quincy College, spoke on "Mary and Franciscan Literature" and Sister M. Petronia, Fel. O.S.E., Madonna College, Plymouth, Michigan, gave a résumé of the purpose and activity of the Library Section

The second meeting, in Parlor A, Hotel Schroeder, Milwaukee, Wisconsin, April 13, 1954, 4:30 P.M., was the joint informal meeting of fifty friars and sisters at the annual conference of the Catholic Library Association. Ambrose Burke, T.O.R. presided over the meeting. Mutual exchange of information about the activities of the two groups was the chief undertaking of this session, with emphasis on progress of the separate projects for indexing proceedings of the conferences. The experience which Vincent Dieckmann, O.F.M. related in working on the F.E.C. Proceedings since Volume 15 (19) was of particular value to Sister Augustine, O.S.F., of Duns Scotus Library, Sylvania, Ohio, who has edited the indexing of the first volume of the Proceedings of the Franciscan Teaching Sisters annual conference.

Library Section Report at the Business Session

Friday Morning, August 19, 1955

The Chairman, Ambrose Burke, T.O.R., made the report on the activities of the past year, as already outlined, and gave this report of the two-hour Library Section meeting held the evening before.

Father Owen Bennett, O.F.M.Conv., Guardian and Rector of the host friary, extended words of welcome to the library group. After the reading and approval of the minutes of the previous meeting, the Chairman called on Father Donald Bilinski, O.F.M., for his report as Treasurer. Twenty-five dollars was the reported expense, devoted to the publication of *Franciscan Librarian Contact* for the year.

There followed the reports of committees and their projects. Irenaeus

Herscher, O.F.M., Librarian at St. Bonaventure University, St. Bonaventure, New York, reported on the Union Catalog of Franciscana. He revealed that about 3000 titles were added to the catalog during the past year. Cooperation by a staff member of the British Museum was the source of a large number of the new titles. Correspondence directed to the Union Catalog at St. Bonaventure University during the past year indicates the measure of usefulness of the continuing project.

Endeavors allied to the Union Catalog are the Subject Heading List and the development of classification schedules.

Donald Bilinski, O.F.M. had been working with another friar who is completing a thesis for a degree in Library Science from Western Reserve University, Cleveland, Ohio. Father Donald's report was that completion and approval of the thesis in September would allow publication of the "List of Subject Headings for Franciscana" shortly thereafter.

Fr. Irenaeus and Fr. Ambrose related continued efforts on their work for the revision of the Dewey schedule and for the adaptation of the Lynn-Petersen Alternative Classification for Catholic Books as applied to Franciscana, but could set no date for their completion.

Vincent Dieckmann, O.F.M., reported good progress on the first volume (volume 16) in the continuation of the indexing of the F.E.C. Proceedings. Important progress was made in the establishment of policies and procedures in the work, for which he derived much benefit through consultation with Joseph Sprug, editor of the Catholic Periodical Index.

Cooperation in the undertaking of the "Annotated Bibliography of Papal Pronouncements on Science" was the subject of a report by the Chairman. George Hellman, O.F.M., Librarian of Duns Scotus College, Detroit, Michigan, had made preliminary investigation for the bibliography and did further work from the files of Sister Claudia, I.H.M., Librarian at Marygrove College, Detroit. Sister Claudia had developed very complete files of indexing for publications printing papal pronouncements in different languages. Her cooperation was most ready and complete.

First among the items of new business was a report on and a discussion led by Father Irenaeus concerning the Serra Subscription Agency. Father Bede, O.F.M., of the Academy of American Franciscan History, is the Director of this agency devoted particularly to serving the magazine needs of Franciscan libraries and of furnishing Franciscan periodicals not always well known or included in general lists. Librarians present were impressed with the amount of planning, study, and experience entering into the functioning of the agency.

Another topic, introduced by the Chairman, Father Ambrose, and commended previously by the President of F.E.C., Father Ignatius Brady, O.F.M., centered around discussion of the establishment of a review and evaluation service for new titles of Franciscana. The need of librarians for help in determining what is a suitable title for a given library—elementary or high school, college or parish—was cited. Father Irenaeus was able to report information that he has been gathering. The service of reviews in such Franciscan publications as *Franciscan Herald and Forum* and *Franciscan Studies* was brought out. The consensus of the meeting was that more investigation of the project was necessary and that a wide range of cooperation must be enlisted.

Some discussion centered around the utility and possibility of having catalog cards printed for titles in Franciscana where they are not available from standard sources, such as the Library of Congress.

One proposal laid before the meeting, and favorably received, was that of having the Library Section enrolled in Institutional membership in the Catholic Library Association.

The final item on the agenda was the matter of providing a speaker for the session of the Library Section in connection with the annual conference of the Franciscan Teaching Sisterhoods at Marian College, Indianapolis, Indiana, November 25, 1955. The Chairman offered to present a treatment of the "Annotated Bibliography of Papal Pronouncements on Science."

FRANCISCAN TEACHING SISTERHOODS

The Fourth National Conference of Franciscan Teaching Sisterhoods was held at Marian College, Indianapolis, Indiana, Friday and Saturday, November 25 and 26, 1955. Under the auspices of the Franciscan Educational Conference, Mother Mary Cephas, O.S.F., Superior General of the Congregation of the Sisters of the Third Order of Saint Francis, Oldenburg, Indiana, was host to some 335 delegates from twenty-seven different Franciscan Communities.

The general theme of the Conference followed that of the August meeting of the Friars: "Nature: the Mirror of God." Pervading the meeting was the conviction that Franciscan education approaches creation with the attitude that the world, whose center is Christ, is not a distraction to draw men away from God, but a means to be used to bring him nearer to his Creator. The universe must be a sacrament of God, a ladder (as Saint Francis would have it) whereby we rise to the Source and Cause of all beauty, order and harmony in creatures.

Morning Session

Friday, November 25, 1955

The Conference opened at 9:00 a.m., with a High Mass of Saint Catherine, in the College Chapel. The celebrant was the Very Reverend Vincent Kroger, O.F.M., Minister Provincial of the Province of Saint John the Baptist, Cincinnati, Ohio. The male choir of the College sang the propers, while the Sisters of the Conference joined in the congregational singing of Mass IX. During the Mass, Father Vincent spoke eloquently of the spirit needed in the Franciscan Teaching Sister, the spirit of faith and the spirit of true Christian love.

The academic session opened at 10:00 in the College Auditorium. After the opening prayer, Mother Mary Cephas, O.S.F., welcomed the Sisters to Marian College in the spirit of true Franciscan

fraternity. In the key-note address which followed, Father Ignatius Brady, O.F.M., President of the Franciscan Educational Conference, stressed the challenge which Pope Pius XII offered to both scientists and philosophers to work out their mutual and individual problems and help achieve a universal synthesis of knowledge needed today. Franciscan scientists and philosophers, he said, could not be slack in accepting such a challenge.

The spirit of reverence was found by Father Leander Blumlein, O.F.M., of Duns Scotus College, Detroit, to be the basic element of "Saint Francis' Attitude toward Creatures." What this implies for the modern Franciscan, whether teacher, scientist, philosopher, was developed through frequent use of modern authors who have constantly turned to Saint Francis as an example and inspiration.

At the close of the morning session a brief talk was given by Father Antonine Tibesar, O.F.M., on the Academy of American Franciscan History, Washington 14, D. C. As Director of the Academy, Father Antonine detailed its history, its prospects for the future, and the publications of high scholarly worth which have been published to the present time.

No program was planned for the lunch hour, to allow the Sisters to examine the exhibits of many science classes and to become acquainted with one another. Several booths of Franciscan literature were also to be found in the exhibit room.

Afternoon Session

The early part of the afternoon was devoted to sectional meetings as follows:

A. Elementary Education.
Chairman: Sister M. Adelaide, O.S.F., Marian College.
Paper: "Nature: the Mirror of God," presented by Sister M. Wilhelmette, O.S.F., Viterbo College, LaCrosse, Wisc.
Demonstrations by the following Indianapolis teachers:
Sister M. Adriana, O.S.F., St. Therese School.
Sister M. Janita, O.S.F., St. Rita School
Sister Frances de Chantal, O.S.F., Our Lady of Lourdes.

B. Secondary Education.
Chairman: Sister M. Bibiana, O.S.F., Cotter High School, Winona, Minnesota.
Paper: "Science Clubs in a Catholic High School," presented by Sister M. Michelle, O.S.F., Mount Saint Francis, Dubuque, Iowa.

C. College Division.
Chairman: Sister M. Joan, O.S.F., College of Saint Francis, Joliet, Illinois.
Paper: "The Complexity of the Atomic Nucleus," by Father Allan Wolter, O.F.M., Franciscan Institute, St. Bonaventure, N. Y.

D. Nursing Education.
Chairman: Sister M. Kateri, O.S.F., Saint Francis School of Nursing, Breckenridge, Minn.
Paper: "The Teacher Evaluates her Students," by Sister M. Aquinata, S.S.M., Saint Francis Hospital School of Nursing, Wichita, Kansas.

E. Library Division.
Chairman: Sister M. Josepha, O.S.F., Holy Family College, Manitowoc, Wisconsin.
Paper: "Backstage a Bibliography," Father Ambrose Burke, T.O.R., Saint Francis Preparatory School, Spring Grove, Pennsylvania.

After an intermission, the General Assembly at 4:00 p.m. heard the Very Reverend Thomas Plassmann, O.F.M., speak on "The *Creatura Mundi.*" Rector of the Seminary of Christ the King at St. Bonaventure, N. Y., Father Thomas is well known for his knowledge of the doctrine of Saint Bonaventure, the Seraphic Doctor. In flowing words he delineated the approach to "the creature which is the world" taken by the Saint in his famous *Breviloquium.*

The last paper of the day was "The Teaching of the Sciences, especially Biology," written by the late Father Philotheus Boehner, O.F.M., Director of the Franciscan Institute. It was read by Father Allan Wolter, O.F.M. Franciscan scientists and teachers who knew Father Philotheus will recognize an unconscious portrait of his own methods in this splendid paper.

Morning Session

Saturday, November 26, 1955

The second day of the Conference was opened with a High Mass of the Immaculate Conception offered by the Very Reverend Gerald Walker, O.F.M.Cap., Minister Provincial of the Province of Saint Joseph, Detroit, Michigan. In his sermon, Father Gerald emphasized the Franciscan spirit that should thoroughly pervade the Teaching Sister. The congregation again joined in singing the Ordinary of the Mass.

At 10:15 a.m., the General Assembly heard an excellent paper from Father Kieran Quinn, O.F.M.Cap., of St. Fidelis College and Seminary, Herman, Pennsylvania. Entitled "The Proofs for the Existence of God and the Natural Sciences," it dwelt on the confirmation which modern scientific knowledge gives to the traditional philosophical proofs for the existence of God. This was followed by an interesting paper on "Patron Saints of Science and Scientists," by Sister M. Germaine, S.S.M., of Saint John's Hospital, Tulsa, Oklahoma. The author listed both official and non-official or popular Patron Saints of each science and many sicknesses.

Afternoon Session

The final meeting of the Conference convened at 1:30 in the College Auditorium, to hear Father Victor Hermann, O.F.M., Dean of Quincy College, Quincy, Illinois, speak on "The Place of the Natural Sciences in Catholic General Education."

A business session followed, with some plans outlined for the Fifth Meeting, in 1956. The chairman was asked to investigate the possibility of a Franciscan form of a *Little Breviary,* particularly on the pattern of that permitted in the vernacular to the Sisters of Germany. At the close of the session, Sister M. Evodine, O.S.F., President of St. Francis College, Fort Wayne, Indiana, presented the Resolutions which her committee had drawn up. Passed unanimously they stressed adherence to the Papal directives and suggestions for Catholic scientists and philosophers, and included a plea for better training of Sisters in both the spiritual life and intel-

lectual preparation before being assigned to active duty in the classroom.

With this, the delegates adjourned to the Chapel of the College, for a brief allocution by His Excellency, the Most Reverend Paul C. Schulte, D.D., Archbishop of Indianapolis, who climaxed the Meeting with Solemn Benediction of the Most Blessed Sacrament.

RESOLUTIONS
OF THE
FRANCISCAN TEACHING SISTERHOODS

The Committee on Resolutions of the Fourth National Meeting of the Franciscan Teaching Sisterhoods submits the following resolutions:

1. *Whereas,* His Holiness, Pope Pius XII, has repeatedly emphasized the problem faced by modern science and by philosophy, and the need of cooperation and collaboration among scientists and philosophers, *be It Resolved:* That Franciscan philosophers and scientists, in loyal devotion to the Holy See and concern for the needs of the Church and the world, accept this challenge and endeavor to make a definite contribution to the solution of such problems.

2. *Whereas,* His Excellency, the Most Reverend Amleto Giovanni Cicognani, Apostolic Delegate to the United States and a member of the Franciscan family, is celebrating the Golden Jubilee of his Ordination to the Holy Priesthood, *be It Resolved:* That this conference extend to the Apostolic Delegate, Seraphic felicitations and good wishes for his continued success as our Holy Father's personal representative.

3. *Whereas,* the Franciscan Teaching Sisterhoods sustained a great loss in the untimely death of Father Philotheus Boehner, O.F.M., philosopher, scientist, and Director of the Franciscan Institute, *be It Resolved:* That this Fourth National Meeting of Franciscan Teaching Sisterhoods extend to the members of his Province and to his co-workers at the Institute, heartfelt sympathy and a promise of prayer for the repose of his soul.

4. *Whereas,* this year 1955 marks the centenary of the founding of the Congregation of the Sisters of Saint Felix, generally known as the Felician Sisters, and *Whereas,* the Sisters of Saint Felix have given outstanding service in the cause of Catholic, Franciscan education during the past hundred years, *be It Resolved:* That this conference extend to all the members of the Felician Congregation hearty congratulations and prayerful good wishes for God's continued blessings upon their work.

5. *Whereas,* the success of the Fourth National Meeting of Franciscan Teaching Sisterhoods is due largely to the wise leadership, careful planning and tireless efforts of the officers, the Advisory and Planning Committee, the speakers, the demonstration groups in the Elementary Section, and to the staff of Marian College, *be It Resolved:* That this conference express its deep appreciation to the president, Father Ignatius Brady, O.F.M.; to Mother Mary Cephas, Superior General of the Congregation of the Sisters of the Third Order of Saint Francis, Oldenburg, Indiana; to Sister Mary Carol, chairman of the local planning committee; to the speakers; to the teachers who supervised the demonstrations and particularly to the staff of Marian College for its fine spirit of true, Franciscan hospitality.

6. *Whereas,* the Franciscan Sisters of Perpetual Adoration of LaCrosse, Wisconsin, in their new Hollywood-produced film, *Every Moment Thine,* have

done much to acquaint the secular world with Franciscan life and spirit, *be It Resolved:* That this conference commend these sisters for their fine project.

7. *Whereas,* a stirring appeal was made by Father Antonine Tibesar, O.F.M., to the Fourth National Meeting of Franciscan Teaching Sisterhoods in an effort to make the Academy of American Franciscan History better known to Franciscans, *be It Resolved:* That this conference give to the Academy unreserved approval and encouragement for the scholarly work it is accomplishing, and pledge to it wholehearted cooperation.

8. *Whereas,* Brother Finbarr, O.S.F., has made a noteworthy contribution in his compilation, *Franciscan Education Directory, be It Resolved:* That this conference extend to Brother Finbarr its sincere gratitude for this helpful volume.

9. *Whereas,* the National Meeting of Franciscan Teaching Sisterhoods is again indebted to Mr. Christopher J. Hogan of the Christopher & Associates, 5252 West Irving Park Boulevard, Chicago, Illinois, for his generous services as photographer at all the meetings of the conference, *be It Resolved:* That the conference extend sincere thanks to Mr. Hogan and recommend his services wherever they may be needed in school or church activities.

10. *Whereas,* the Holy Father, Pope Pius XII, in his counsel to teaching sisters urges their training in personal, moral and spiritual perfection, and *Whereas,* the Holy Father likewise stresses the need for preparing religious teachers in a manner that corresponds in quality and academic degrees to that demanded by secular accrediting agencies, *be It Resolved:* That this Fourth National Meeting of Franciscan Teaching Sisterhoods recommend to superiors, General and Provincial, that no teacher be sent into a classroom until she is prepared religiously, educationally and professionally for her important responsibility of instructing and guiding youth.

Report of the Library Section

November 25, 1955

The meeting of the Library Section was called to order by the chairman, Sister M. Josepha, in the reading room of the Marian College Library. Father Donald Bilinski, O.F.M., led the opening prayer.

The proposed constitutions were read by Sister M. Claire, Chairman of the Constitutions Committee. Copies will be sent to all known Franciscan Sister librarians. It is hoped that the group will be ready to discuss and vote on them at the November meeting in 1956.

It was agreed that the *Franciscan Librarian Contact,* edited by Father Donald Bilinski, O.F.M., Provincial Librarian, Pulaski, Wisconsin, would serve as the news medium for the Sisters' as well as the Friars' Library Section.

During the past year work was begun on indexing the first volume of the Proceedings of the National Conference of Franciscan Teaching Sisterhoods. Copies of the first draft were distributed to all present. A request was made for an evaluation of several specific points. It was decided that the indexing of volumes two and three should be undertaken by the group, with Sister Mary Augustine, continuing as editor.

Father Antonine Tibesar, O.F.M., acquainted the members with the services of the Serra Subscription Agency, a newly formed agency to supply libraries with the best periodicals on the market in Catholic and secular fields, stressing those Franciscan, both American and foreign.

At the request of Father Ignatius Brady, the question of the inadvisability of publishing two separate proceedings for the Friars' and Sisters' meetings (since there is so much duplication of material) was discussed. The possibility of incorporating the material from both sections, or putting additional papers from the Sisters' section in an appendix was considered. The general consensus of opinion was that the group would like to see the practice of publishing the proceedings in separate volumes continued.

The idea of the compilation of a book-review digest for Franciscana was presented to the section for consideration. The proposition was well received, but as yet no definite action on it has been taken.

Attention was called to the dearth of material, with the exception of biographies of St. Francis and St. Clare, on Franciscan saints on the elementary school level.

It was moved and accepted that the same slate of officers be retained until the constitutions are adopted. These are: Chairman, Sister M. Josepha, Holy Family College Library, Manitowoc, Wisconsin; Vice Chairman, Sister M. Adelaide, Bishop McMahon High School Library, Buffalo, New York; Secretary and Treasurer, Sister Mary Augustine, Duns Scotus Library, Sylvania, Ohio.

Father Ambrose Burke, T.O.R., Chairman of the Friars' Library Section of the Franciscan Educational Conference, gave the group the benefit of his experiences and work in compiling a bibliography of the Papal Pronouncements on Science of Pius XII. It is Father's means of doing his bit in the Franciscan apostolate today—"To mirror Christ as St. Francis did."

SERMON *

Very Rev. Vincent Kroger, O.F.M.

"Those who instruct many unto justice shall shine as stars in the firmament for all eternity." (*Dan.* 12, 3)

My dear Sisters in St. Francis:

A communist leader who was watching a procession during a Marian year celebration turned to a priest who was standing near and said: "If we had the faith and numbers of you Catholics we could overturn the world." The priest looked at him and answered: "We have no intention of overturning the world; but we want to turn it over to Christ." In the words of our Holy Father we want to "renew all things in Christ." And how can we best accomplish that purpose? By education. Therefore, we became religious and teachers and Franciscans. There are hundreds of thousands and even millions of teachers in the world, who for the most part are not concerned about turning the world over to Christ or renewing all things in Christ. But that is our special vocation in life and we must be equipped and disposed to accomplish it.

It is a spiritual equipment and a supernatural disposition which is needed. It is simply a spirit of faith and a spirit of love that must become part of us. Every religious is like the Holy Sacrifice of the Mass which is called the Sacrament of Faith and the Sacrament of Love. And just as the Holy Sacrifice is the Memorial of our Lord's Passion and the means by which the fruits of Christ's redemption are applied to men's souls, just so the religious and preeminently the Franciscan religious is intended by Divine Providence to channel the fruits of redemption to the souls of men. And what is that but to renew all things in Christ?

But I have said that a spirit of faith is necessary to accomplish this purpose. Why? According to the Council of Trent, faith is the beginning, the basis and the root of all justification, which means that we cannot even get started on the way to God without faith. More than that, every step that we make in that direction must be supported and sustained by the supernatural virtue of faith. And we are not yet speaking about teaching. We are referring only to the teacher and we are saying that first of all she must be thoroughly imbued with this quality of faith. As was said of Abraham of old, she must "live by faith." All of her thoughts and words must be guided and directed by faith. All of her judgments must be based on this outlook of faith.

Oh yes, the modern world says we do not have academic freedom, we are hampered and restricted by the truths which faith teaches us. But the modern world does not ask us to take the loyalty oath. When we say we want to turn the world over to Christ, we are not suspected to mean the overthrow of the government, a world revolution to deprive individuals of their God-given rights. Even the votaries of the world know that Christ our Lord stands for peace and justice and respect for every human individual. And we do have academic freedom in the meaning of past centuries, the ages of faith. We have

* Fourth National Convention of the Franciscan Teaching Sisterhoods, Indianapolis, Indiana, November 25, 1955.

academic freedom in the best sense of the words. We have not the least intention or desire to go beyond the limits of divine revelation and Catholic tradition. Why should we? As one author expresses it, that would be like going into a dark room, without a light, to look for something that isn't there. Faith, after all, is not a restriction but a guide, it does not coerce us but leads us. Faith improves our intelligence, elevates it, protects it from error. St. Augustine tells us that faith is the greatest gift that can come to our human intelligence. Therefore, far from ever being ashamed of this greatest of all gifts to our human nature, we should be immensely proud of it and thank God sincerely for giving it to us. Then if we wish to follow up the thought of St. Augustine, we have another reason to thank God because he says that next to the grace of divine faith the greatest blessing that can come to a human being is the grace of a religious vocation. We can even go a step farther and find another basis of gratitude to God. It is our Franciscan vocation. Of all the types of religious vocation to which we might have been called certainly none is more glorious, more deserving of our humble gratitude than the one with which God has favored us, to be followers of the great St. Francis. And if sometimes we are inclined to be disturbed by the thought of the responsibility attached to these immense graces, we cannot do better than to try to be like the Holy Sacrifice, a channel of divine grace to our fellow men. I have tried to explain that we do that by living and acting in a spirit of faith. And the second requisite is that we live and act in a spirit of love.

Our Holy Father the Pope in a recent speech to the Italian Educational Association said in regard to the education of children: 1) it must be started as early as possible and include the basis of all moral education, the distinction between right and wrong; 2) it must be animated with christian principles. Then our Holy Father treats of the teachers and says that they must be properly trained so as to develop the maternal spirit within them. The Pope goes on to explain that a mother naturally becomes an educator of her children; but a professional teacher or educator must develop within herself the maternal spirit. Perhaps never before so much as today, the world needs this maternal spirit to draw it away from the present currents of violence, oppression, coarseness, into which men have fallen. In this sphere the religious teacher can draw enlightenment, strength and inspiration from our Holy Mother the Church.

Back in 1915, a professor at Johns Hopkins University gave a strange assignment to his students. He told them to go to the slums of the city and there contact some two hundred boys between the ages of 12 and 16 and after interviewing each one regarding his background and environment predict the boys' chances for the future. The students did as they were told and gave the estimate that at least ninety percent of those boys would eventually serve time in the penitentiary. It was a sad and gruesome outlook; but those were the facts. Just twenty-five years later, 1940, another professor at Johns Hopkins gave an equally strange assignment. He told his students the names of those two hundred boys who were interviewed in 1915 and asked them to try to contact them or at least find out what happened to them. The students did the best they could. Some of those individuals had died, some had moved away; but they received definite information regarding 180 of the 200. How many of them had served time in the penitentiary? Just four. The students wondered why the predictions were so wrong. They asked these men the reason. Again and again the answer: "Well, we had a teacher in school."

Seventy-five percent of the men interviewed referred to this same teacher. Upon inquiry, these research students learned that the teacher was still living; but she was in a rest-home. They went to see her to find out the secret of her great influence on her pupils. She had no particular explanation to give; but as she thought back to those years she mused: "I loved those boys." That was the whole explanation.

I am sure that similar instances could be told about the Sisters here present. On the day of judgment, God's recording angel will open the records for all to see. And then it will be known how great good was accomplished by the Franciscan Teaching Sisters who endeavored to live and act and teach in a spirit of supernatural faith and a spirit of supernatural love. Then it will be revealed how each one of you served as a channel of divine grace for your fellowmen. We know that the fruits of our Lord's redemption are infinite. It is only necessary that they be directed to men's souls in such a manner that men are willing to accept them. Let's beg St. Catherine Virgin and Martyr, patroness of those who seek true wisdom, whose feast we celebrate today, in whose honor this Holy Mass is celebrated, to intercede for us that we may be ever more solicitous for the supernatural disposition of faith and love, because only then shall we fulfill completely our life's vocation as teachers, religious and Franciscans. Only then shall we deserve the fulfillment of God's promise: "Those who instruct many unto justice shall shine as stars in the firmament for all eternity." (The Knox translation renders the passage thus: "Bright shall be the glory of wise counsellors, as the radiance of the sky above; starry-bright forever their glory who have taught men the right way.")

ADDRESS OF WELCOME *

Mother M. Cephas, O.S.F.

Very Reverend Father Provincial, Reverend President of the Franciscan Educational Conference, Reverend Fathers, Mothers, and Sisters in Saint Francis: With "Pax et Bonum" we welcome you to the Fourth National Meeting of Franciscan Teaching Sisterhoods. We deem it a distinct privilege, an honor, and a blessing to have so many Franciscans with us here at Marian College. We want to share our Franciscan facilities with you. Our Chapel, our college, our convent are yours. Be at home with us these heaven-blest days.

Once upon a time a lad of nine years confided to his mother, "Mother, I'm going to try to find out more about that St. Francis Sister told us about this morning. I like him because he liked short prayers; he just said, 'My God and my all,' and that was all."

That is why we have come together from near and from afar, to learn more about our holy Father Francis, to learn more about the God of Francis, to understand a little more clearly the love, the simplicity, the comprehensiveness of our holy Father's "Deus meus et Omnia."

Many times we have fervently and sincerely prayed in St. Francis' own words: "Lord, my God, I have given Thee all my heart and all my body, and I earnestly desire, if I only knew how, to do still more for Thy love." May we not look upon this Franciscan conference as a timely answer to our plea for intensified and unified love and service?

We are eager for the help that will come with the study, observations, and discussions on Nature: the Mirror of God—and this according to Franciscan theology. The various activities, the combined energies, and unselfish sharing of ideas concerning the greatness, the power, the wisdom, the beauty, and the love of Our Father, Our Creator, who called from nothingness all creatures to help us become increasingly conscious of Him and of our destiny of union with Him will truly lend to the knowledge that we so often ask for when we pray in the Pater Noster of St. Francis, "Hallowed be Thy Name: may Thy knowledge shine in us that we may know the breadth of Thy benefits, the length of Thy promises, the height of Thy majesty, the depth of Thy judgments." We should all be better Franciscans, better servants of God, better servants of man for having been privileged to be one of this group of eager to learn, eager to give Franciscans.

May this conference be the cause of a variation of the well-known Fioretti story of the colloquy between St. Francis and Brother Leo on "Perfect Joy." Brother Leo, when you see our Friars nobly and considerately providing and sharing what they have with our Sisters, doing all they can to quicken their minds, and hearts, and wills to a greater love and service of the most high King and our august Queen, Brother Leo, I say to you, this is perfect joy.

* Fourth National Convention of the Franciscan Sisterhoods, Indianapolis, Indiana, November 25, 1955.

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